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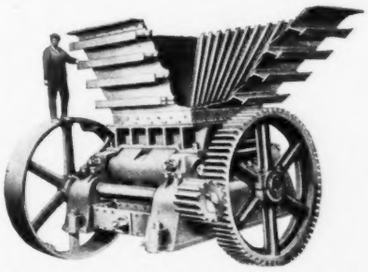
Chicago, March 21, 1925 (Issued Every Other Week) Volume XXVIII, No. 6

"PENNSYLVANIA"

A COMPLETE LINE OF STEELBUILT CRUSHER EQUIPMENT FOR MODERN CEMENT, LIME AND GYPSUM PLANTS



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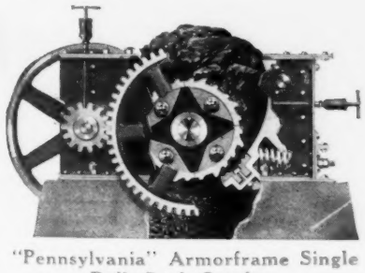

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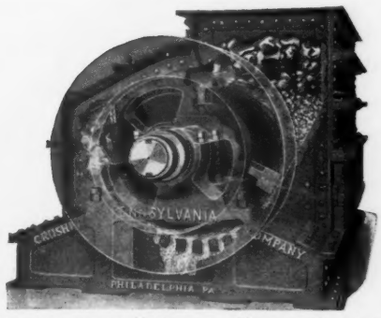

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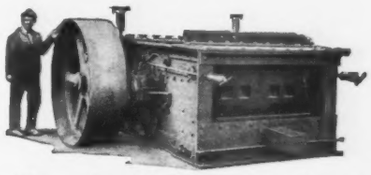

"Pennsylvania" Super-Armorframe Steelbuilt Single Roll Secondary Crusher

for limestone, cement rock, gypsum, and shale.

For smaller feed and capacities than the GIANT ROLL, and for making finer product. Slab steel construction, cut steel gears and powerful relief springs.

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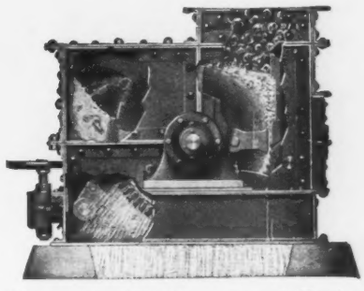

"Pennsylvania" Samson and Trojan Series Steelbuilt Hammermills

for finer reductions of limestone, lump lime for hydrating and burned gypsum.

Equipped with renewable Manganese Steel liners, fitted with tramp iron separator and easy cage adjustment.

Capacities 15 to 100 tons hourly.

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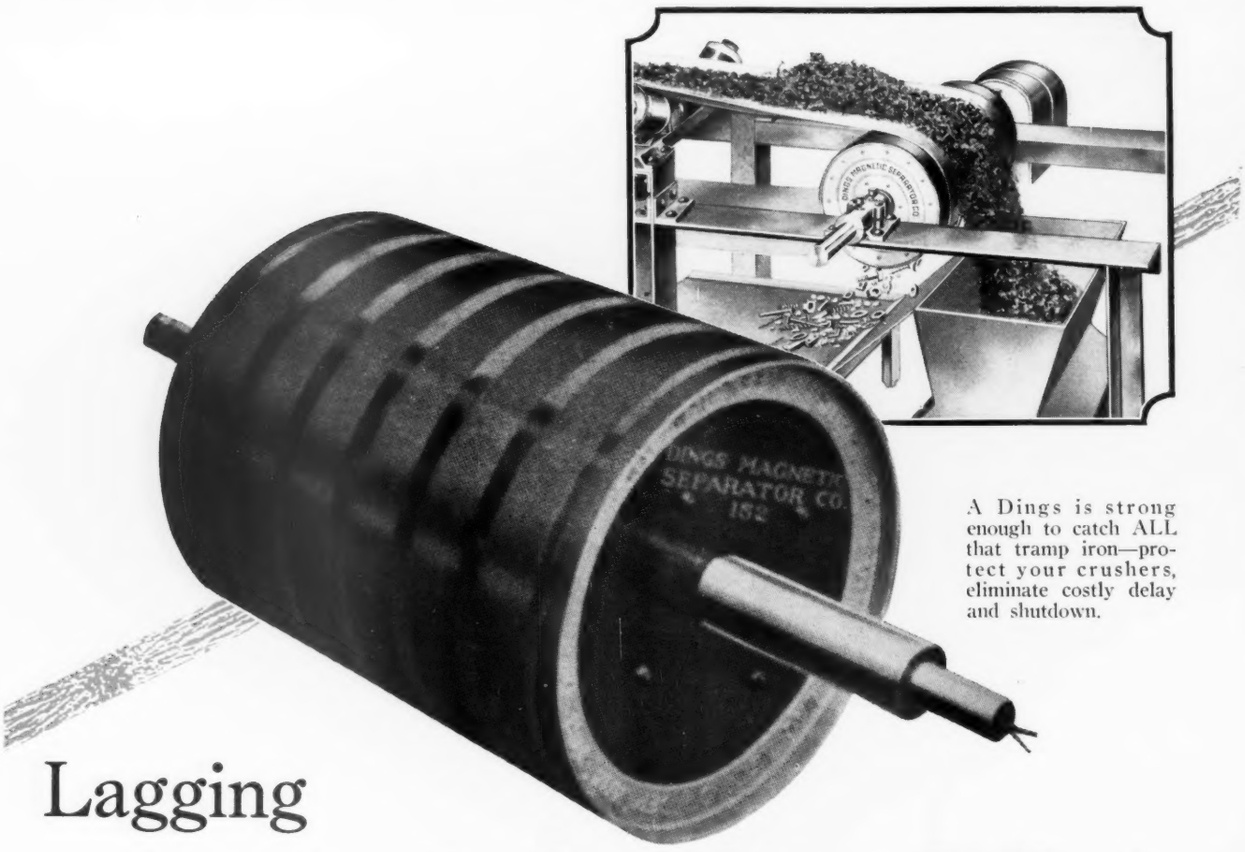

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Rock Slides Once Waste—Now Valuable

Present Values of Ganister Deposits and Their Development

By R. W. Stone
Pennsylvania Geological Survey, Harrisburg, Penn.

LONG stretches of steep mountain sides in central Pennsylvania are covered with rock slides or floes many acres in extent and up to 35 ft. deep. These floes are made up of rock broken from the ledges above by the action of rain and frost, and by tree roots prying the rocks apart. The process is slow and the time during which these floes have been accumulating may be thousands

Ganister floe in Jacks Narrows near Mount Union, Penn., looking east along the Juanita river

Floe on Jack's mountain on the Juanita river at the operations of the Harbison-Walker Refractories Co.

of years. The rocks that form these floes are hard and durable and are not noticeably subject to disintegration by solution. As they have been broken up by mechanical processes, they have angular rather than rounded faces. Most of the rock is a very hard sandstone or quartzite and the blocks range from a few pounds to 10 tons in weight.

Less than a quarter of a century ago the land covered by these rock slides was generally believed to be the most worthless in Pennsylvania. It would not grow even trees. Hundreds of acres of it were sold for taxes because nothing could be raised on it, and the stone seemed to be valueless. This is changed now. The land will grow nothing, but the rock is saleable.

The rock formation that furnishes the material for the floes is the Tuscarora (Medina) quartzite. It is the greatest mountain-forming rock in central and southern Pennsylvania and outcrops for hundreds of miles in the ridges extending from Williamsport and Delaware Water Gap on the north and east to the Maryland line on the south. This rock consists almost entirely of grains of quartz, and analyses of the samples from many places show that it contains more than 97% silica. Not all of the floe rock is of this quality, however. Some floes contain so little of the high grade rock that they are of little value, not even if directly on a railroad. The high grade quartzite is called ganister rock and is used for making silica brick. The principal use of silica brick is in metallurgical industries to make a lining for furnaces that must withstand very high temperatures. They are used also in coke ovens, lime kilns, furnaces for glass making and other places requiring a lining that will be rigid and strong at high temperatures.

Because of the demand for silica brick the great areas of supposedly waste rock on the mountain sides began to have potential value. This ganister rock can be ground, mixed with lime and made into highly refractory brick. The floes of suitable rock close to transportation naturally were used first, and as these began to be depleted the floes farther back in the mountains were acquired by the manufacturers of refractory brick. Only a few years ago much land covered by large floes of good rock could be bought at land tax sales for a few dollars an acre. Now some land situated near operating quarries is held at $100 an acre, and as high as $250 has been paid for some tracts that contain an abundance of good ganister. The royalties paid on rock have been about 4 cents a ton, with a range from 2 to 10 cents a ton, depending on location. The higher figures were wartime prices. Last spring the Pennsylvania Department of Forests and Waters leased rock rights on certain tracts in the state forest at 6½ cents a ton, a price which makes this waste land far from valueless.

Quarrying Silica for Refractories*

Some Special Methods and Devices

By E. S. Moore and T.G.Taylor
Pennsylvania Geological Survey, Harrisburg, Penn.

TWO types of quarrying operations are practiced in securing quartzite, (1) quarrying or stripping the loose, broken talus, or "floe rock," which forms great sheets or piles along the mountain flanks, and (2) quarrying the solid or "ledge rock." In stripping the floes, which in some cases are a mile or more in length, several hundred feet wide, and from 2 to 35 ft. thick, the operation is comparatively simple. A plane is constructed, running up the mountain face to the floe and tracks are laid from the plane along the mountain so that the broken rock may be worked in benches. Back switching is used in climbing the steep grades. As rapidly as the rock in one locality is exhausted the tracks are moved to another.

The rock is broken with sledges and loaded into the cars by hand. Considerable care must be exercised in removing the loose rock to prevent fragments from rolling down the mountain and injuring the workmen, or to avoid large masses of the talus sliding down over the tracks. In most strippings where grades are very steep masses of talus are left at intervals to serve as anchors or buttresses and thus prevent large slides. In loading, careful sorting is necessary where the floe rock is not of uniform grade. Where one of the adjacent formations lies sufficiently high up on the mountain for its outcrop to supply undesirable material to the talus this material may be discarded.

In stripping the talus practically no blasting but "mud capping" is necessary. This is employed where boulders are too large to be broken with a sledge. It consists in placing one or two sticks of dynamite on a block which is to be broken, covering these with clay or sand and firing the charge with a fuse. A number of these charges are fired in one firing period so as to interfere as little as possible with the operations in the quarry. Where there are many large and tough blocks, some of these may be drilled by hand or with a jackhammer and the charge is placed in the holes, which are often spoken of as "block holes." A charge of given strength will do more in such a hole than in mud capping, but the time spent in drilling is an important consideration.

In quarrying the ledge, or solid rock, an excavation is made either by blasting out the quartzite or prying it out with bars. In some quarries the rock is "tight" and most of it must be blasted; in others much rock may be "seamed" out where the beds are not too thick and there are clay seams and joints along which the blocks separate readily. The drilling in some of the smaller quarries is done by hand, but in most quarries the jackhammer drill run by compressed air is used. The tripod drill D24 was also seen in some quarries where it is used to advantage in heavy-bedded rock. Blasting is mostly done in "snake holes" and 40% dynamite is the explosive used.

*From a recent report "Silica Refractories in Pennsylvania" issued by the Pennsylvania Geological Survey.

To save drilling, dynamite may be placed in a hole made with a bar in a clay seam. A small charge is first fired in the hole and this is increased until a large charge of between 100 and 200 lb. of 40% dynamite can be added and a great deal of rock moved.

Some quarries are situated along the crest of a mountain and the overburden of clay and broken rock does not cause much trouble, but in others the debris which is continually working down into the quarry adds much to the expense and danger in quarrying. The debris runs, on the average, about 1 ton in 3 of material removed. It may be considerably more or less than this in various quarries, as the relative amount depends much upon the situation of the quarry on the mountain. The ideal location, so far as the overburden is concerned, is in the crest of the mountain. The lower down the mountain side usually the greater danger from rolling boulders or sliding cover and the thicker the overburden, other things being equal.

Waste Rock Disposal

In quarrying, the rocks can be broken more readily working with the dip, but the overburden is more troublesome and cannot be so readily controlled as when quarrying in the direction opposite to the dip. Working parallel to the strike is probably most satisfactory where it can be followed. In most places where quarrying is carried on there is fortunately very little difficulty in disposing of the waste rock since the majority of the quarries are situated on mountain faces or hillsides which are uninhabited and unsuitable for agricultural purposes. Most of this debris is moved by hand because the situation of the quarry and the nature of the overburden make it difficult, or impossible, to strip the formation with steam shovels. Scrapers may be used in some places and in one quarry a Thew electric shovel of ¾-yd capacity was seen in operation for loading dirt or second-grade rock.

The drainage problem is of little importance in most of these quarries since they are situated on high lands and natural drainage takes care of the water. Loading is done almost entirely by hand. Automatic loading devices cannot be relied upon for loading high grade rock because they will not sort the material and remove the clay and fragments of inferior quality. The quarry cars used in various quarries hold from 2¼ to 4 tons each. The average man will load 15 to 20 tons of stone a day and where two men work together they will load 25 to 30 tons each in a day. A foreman stated that one man made a record in loading 20 cars in a day, the cars holding about 2¼ tons of stone.

Quarry Haulage

Since most of the quartizite quarries are at high levels, the rock must be brought down considerable distances to the railroads or brick plants. If the loading station or brick plant is near the foot of the hill on which the quarry is situated the rock is hauled to a tipple at the head of a gravity plane and dumped into cable cars which carry it to the hoppers at the crushing plant or to the bins of the loading plant.

The gravity plane includes a steel cable wound on a drum or around two sheaves, 5 or 6 ft. in diameter, in the form of a figure 8. The speed of rotation of the sheaves is controlled by grooved wooden brakes. The rails may be arranged so that there are three, with a switch in the center, or three in the upper part of the plane and two in the lower part with one line of cable below the center and two above. One or more cars may constitute a trip on the plane.

The size and distance of the quarry from the head of the plane determine whether cars shall be hauled by mule or dinky engine or pushed by hand.

Relative Advantages in Quarrying Floe and Ledge Rock

Up to the present time by far the greater part of the quartzite used for ganister and silica brick in Pennsylvania has come from the talus floes. As this type of deposit becomes less abundant a much larger proportion of the rock used will be quarried from the ledge or solid formation. Some companies even now have begun to draw their supplies almost entirely from the solid formation. There are certain advantages and disadvantages in quarrying these two types of deposits. The advantages in using the floes lie in the general higher grade of the raw material and the lower cost of quarrying. Quarrying the solid formation permits easier superintendence and easier operation because of restricted area, and in some cases gives greater uniformity in the character of the rock produced.

Costly Competition

THE most costly form of competition with which every industry has to contend, the Department of Manufacture of the Chamber of Commerce of the United States has found, is ignorance. This is disclosed, for example, in quotations to the government for supplies of every description. These force the manufacturer in nearly every line of industry to the pessimistic conclusion that some of his competitors have little or no idea of costs, for at one time or another offers are made at prices lower even than the cost of materials.

In its study of cost accounting the Department of Manufacture of the National Chamber has, in the course of five years during which it has come in contact with representative executives of various industries, discovered that this is a general condition. Legitimate competition is a spur to greater effort, but ignorance is an unknown quantity against which there is no defense.

The chief function of Rock Products is to help overcome ignorance in the industry which it serves. That is the object of our plant descriptions, our numerous editorial efforts, our current prices of materials and news of the industry. Only the co-operation of our friends and readers make the success of this objective possible.—The Editors.

Ganister quarry (looking west) in Jacks Narrows near Mount Union, Penn.

Changes Made in Specifications for Crushed-Stone Railway Ballast

American Railway Engineering Association at Annual Meeting Makes Important Revisions in Recommended Standards

THE American Railway Engineering Association, in convention at Chicago, Ill., March 11, adopted the report of its committee on ballast, incorporating a revision of the specifications for crushed-stone ballast. F. J. Stimson, chairman of the ballast committee, chief engineer of maintenance, southwest region, Pennsylvania Railroad System, St. Louis, Mo., has been a guest at the two most recent conventions of the National Crushed Stone Association.

The committee recommended continued study and ultimate revision of washed gravel ballast specifications. It also recommended a thorough-going study of the cost of track maintenance with different kinds of ballast taking into consideration various conditions of traffic, speed, roadbed, climate and cost of ballast production.

Investigation of Crushed Stone Ballast

"The committee sent the following questionnaire to the railroads during the year:

1. Kinds of stone used?
2. Character of traffic?
3. Size of ballast—minimum and maximum?
4. How long have you used these sizes?
5. Do you find sizes you use satisfactory in all respects?
6. If not, what changes would you recommend, and why?
7. Does your ballast foul quickly through cinders or coal dust collecting in it?
8. Do you think a smaller size ballast would prevent or delay the deteriorating of your ballast?
9. Do you recommend different sizes of ballast for different character of traffic, i. e., fast passenger traffic or slow, heavy freight traffic?
10. If so, what size for each kind of traffic do you favor?
11. Do you recommend different sizes of ballast for different kinds of stone?
12. If so, what size for each kind of stone?

"Replies were received from 43 railroads using stone or slag for ballast. A tabulation of the sizes used is given below:

Maximum Size

	3 in.	2¾ in.	2⅝ in.	2½ in.	2¼ in.	2 in.	1¾ in.	1½ in.
No. of roads	6	1	1	24	2	6	1	2

Minimum Size

	1½ in.	1¼ in.	1 in.	¾ in.	½ in.	⅜ in.	¼ in.	No lower limit
No. of roads	1	3	8	16	9	3	1	2

"The questionnaire developed no sentiment for different sizes of stone, for different character of traffic or any opinion that smaller size ballast would prevent or delay deterioration through dirt collecting in it. Eight roads favored different sizes for different kinds of stone.

"In view of the information developed by the questionnaire, the committee decided to make three-fourths (¾ in.) inch the minimum and two and one-half (2½ in.) inch the maximum size for ballast.

"In considering the matter of physical tests, the committee reached the conclusion that rock meeting the requirements for weight, toughness, soundness, wear and cementing quality will necessarily be satisfactory in strength, absorption and solubility. The last named tests are, therefore, omitted in the proposed specification.

"It is obvious that a sample of stone from a given quarry may test better in some qualities and poorer in other qualities than samples taken from a number of other quarries. In order that the tests given in the specifications may be a definite indication of the relative value as ballast of the various samples, some method whereby an equated value may be placed on the result of each test is necessary. The summation of such equated values of the various qualities will be the equated value as ballast (in whatever scale adopted) of the sample and a comparison of such equated values of the samples from various quarries will indicate the relative value as ballast of the stone from the various quarries tested.

"Until such a method is evolved the full value of the tests given in the specification cannot be realized. The tests can be used only to check the material to be furnished from a given quarry and will give no measure by which the quarry producing the most valuable stone for ballast may be selected.

"A formula for arriving at such an equation has been under consideration by the committee, but sufficient information from which to supply the indices in such a formula are not yet available.

Conclusions

"The following revised specification for stone ballast is therefore submitted:

REVISION OF SPECIFICATION FOR STONE BALLAST

Present Specification	Proposed Specification
General	**General**
1. Stone for use in the manufacture of ballast shall break into angular fragments which range with fair uniformity between the maximum and minimum size specified herein; it shall test high in weight, hardness, strength and durability, but low in absorption, solubility and cementing qualities.	1. Stone for use in the manufacture of ballast shall break into angular fragments which range with fair uniformity between the maximum and minimum size specified herein; it shall test high in weight, toughness, wear and soundness, but low in cementing qualities.
Tests	**Tests**
Tests shall be made as follows:	Tests shall be made as follows:
2. WEIGHT. Not less than one-half cubic foot of the stone accurately measured, and dried for not less than twelve hours in dry air at a temperature of between 125 and 140 deg. Fahr., shall be weighed. The weight shall be not less than — lb. per cubic foot. (Note—Of the stone available, that having the maximum weight should be used; a high quality stone for ballast will weigh 168 lb. per cubic foot.)	2. WEIGHT. Not less than one-half cubic foot of solid stone accurately measured and dried for not less than twelve hours in dry air at a temperature of between 125 and 140 deg. Fahr. shall be weighed. The weight shall be not less than — lb. per cubic foot.
3. STRENGTH. Two-inch cubes of stone shall be sawed to reasonably accurate dimensions and the top and bottom faces made accurately parallel. For the primary tests, the test specimen shall be dried for two hours in dry air at a temperature of between 120 and 140 deg. Fahr. and at the time of test the temperature of the specimen shall be not less than 50 deg. Tests shall be made in a testing machine of standard form and the stone shall have a compressive strength of — lb. per square inch. (Note—Of the stone available, that having the maximum compressive strength should be used; a high quality stone for ballast will have a strength of 10,000 lb. per square inch.)	3. TOUGHNESS. A piece of solid rock from which a cylindrical core perpendicular to the bedding plane of the rock, 25mm x 25mm (0.98 in. x 0.98 in.) can be cut with a diamond core drill, and the ends ground plane shall, after drying, be held on an anvil, weighing not less than 50 kg. (110.23 lb.) in the Page impact machine, like a miniature pile driver, under a plunger with sphere shaped striking surface of 1 c. m. (0.39 in.) radius, which is struck by a hammer when released weighing 2 kg. (4.4 lb.). The test begins with a 1 cm. (0.39 in.) fall of the hammer for the first blow, and continues with an increased fall of 1 cm. for each succeeding blow until the test piece fails, the number of blows and height being the same and representing the toughness of the rock. Rock that shows a toughness of less than —— shall be rejected. (A.S.T.M.D. 3-18.)

Present Specification	Proposed Specification
A secondary test shall be made on specimens the same in all respects as for the primary test except that the block shall have been completely immersed in clean water, of a temperature between 35 and 90 deg. for 96 hours, the test to be made within 30 minutes of removal from the water. If the compressive strength shall have decreased more than —% from the primary tests, the rock shall be deemed unsuitable for ballast purposes. (Note—Of the stone available, that showing the least difference between the results of the primary and secondary tests should be used; a high quality stone for ballast should show not over 1% difference.)	
4. SOLUBILITY. One-fourth cubic foot of the rock shall be crushed and thoroughly washed. The particles shall then be placed in a glass vessel and covered with clear water. The vessel shall then be thoroughly shaken for five-minute periods at 12-hour intervals for 48 hours. If any discoloration of the water occurs, the rock shall be deemed soluble and undesirable for use as ballast.	4. SOUNDNESS. Ten small pieces (total weight about 1000 grams 2 lb.) of the rock shall be immersed in a saturated solution at 70 deg. Fahr. of sodium sulphate (Na_2SO_4) for 20 hours, after which they shall be placed for four hours in a drying oven maintained at 100 deg. C. The treatment shall be repeated five times. Rock which exhibits checking, cracking or disintegration shall be rejected.
5. WEAR OR DURABILITY. (Test No. 1.) One-half cubic yard of crushed stone, which will pass through the maximum and be retained on the minimum screen, shall be spread over a wire mesh or iron surface to a depth of not more than 3 in., and exposed to a dry heat of from 125 to 140 deg. Fahr. for a period of two hours. After the dried stone is carefully weighed it shall be given 10,000 revolutions in a tumbler approximately 4 ft. in diameter, of not less than 2 cu. yd. capacity, and operating at 25 revolutions per minute. The sample shall then be passed over a screen of the minimum dimension provided for sizing ballast, again washed and dried in the same manner as before the test, and again carefully weighed. If the decrease in weight shall be more than —% of the original weight of the sample, the stone shall be deemed unfit for use as ballast. Outside of the breakage, which is exhibited by the small particles which will pass through a minimum screen but will not pass a sieve of 20 meshes to the inch, the wear should not exceed —%. (Note—Of the stone available, that showing the smallest loss in weight should be used; a high quality stone for ballast will show a loss of not more than 1% in fragments which will pass a screen of 20 meshes to the inch, and not more than 3% in those passing the minimum sizing screen.)	5. WEAR. Five kg. (11 lb.) of freshly broken fragments of stone as nearly alike as possible, shall, after thorough drying, be placed in hollow iron abrasion cylinders, 20 cm. (7⅞ in.), a 34 cm. (12.4 in.) in depth in diameter, which are revolved at the rate of 30 revolutions per minute for 10,000 revolutions for each test, after which the pieces shall be thoroughly washed, dried and weighed and the percentage of dust or detritus by weight that will pass through a screen with 1.6 c.m. (1/16 in.) mesh shall be considered the percentage of wear. Rock that has a greater percentage of wear than — for trap rock, and — for limestone, shall be rejected. (A.S.T.M.D. 2-08.)
Test No. 2 (Quick Weathering Test). One-half cubic yard of stone shall be dried and weighed as for Test No. 1. It shall then be immersed in water for six hours and then, while still wet, be placed in a refrigerating plant and subjected to a temperature of approximately zero Fahr. for two hours. It shall then be removed and the temperature gradually raised in two hours to 100 deg. and that heat continued for two hours, when it shall be immersed as before and again subjected to approximately zero temperature. The freezing and thawing shall be repeated to a total of ten exposures. If any tendency to disintegrate is observable the stone should be considered unsuitable for ballast. Otherwise the material shall again be subjected to a wear test as provided under Test No. 1. If in this wear test the maximum decrease in weight shall be in excess of —%, it shall be deemed unsuitable for use as ballast. (Note—Of the stone available, that showing the minimum average decrease in weight should be used; a high quality stone for ballast will not show a decrease in fragments which will pass the minimum sizing screen of more than 4%.)	
6. ABSORPTION. One-half cubic yard of washed stone, which will pass through the maximum and be retained on the minimum screen, shall be spread over a wire mesh or iron surface to a depth of not more than 3 in. and exposed to a dry heat of from 125 to 140 deg. Fahr. for a period of six hours. After the dried stone is carefully weighed it shall be submerged in clean water for a period of 96 hours. It shall then be removed from water and exposed to a normal air in the shade and at a temperature between 40 and 80 deg., and allowed to drip for 30 minutes, when it shall again be weighed and the difference in weight shall be used to determine the rate of absorption. Stone showing an absorption of more than — lb. per cubic foot is unsuitable for ballast. (Note—Of the stone available, that showing the minimum absorption should be used; a high quality stone for ballast will have an absorption of not more than 0.50 lb. per cubic foot.)	
7. CEMENTING QUALITY. A 5-lb. sample of the rock thoroughly washed and dried shall be crushed until it will pass through a screen of ¼-in. mesh. This material shall be placed in a ball mill which contains two steel shot weighing 20 lb. each, and the mill revolved at the rate of 30 revolutions per minute, until it has made	6. CEMENTING QUALITY. One-half kg. (1.1 lb.) of stone which can be crushed to pea size, shall be placed (dry) in a ball mill which contains two steel shot weighing 9.07 kg. (20 lb.) each, given 5000 revolutions at the rate of thirty (30) revolutions per minute, and the dough resulting from a mixture of the dust,
2000 revolutions for each pound of sample in the mill. Sufficient clean water shall be added to make a consistent mortar, which shall then be moulded into 1-in. cubical briquettes, formed under 10-lb. pressure. All of the briquettes shall then be allowed to dry 20 hours in the air, when one-third of them shall be tested for compressive strength. One-third shall be kept for four hours in a steam bath, and the remainder shall be immersed for four hours in clean water at a temperature between 50 and 60 deg. Fahr. and then tested for compressive strength. If in any of these tests a compressive strength greater than — lb. per square inch is developed, the material shall be deemed unsuitable for ballast. (Note—Of the stone available, that from which the briquettes show the minimum strength should be used; a high quality stone will show not to exceed 4 lb. per square inch.)	screened through a 100-mesh sieve, and water, placed in an air tight vessel for three (3) hours, and then rekneaded, shall be made into six cylindrical briquettes 25 m.m. (0.98 in.) in diameter and 25 m.m. in height and formed under a pressure of 132 kg. per sq. c.m. (1877.5 lb. per square inch) after which they shall be allowed to dry 20 hours in air, four hours in a hot air bath at 100 deg. C. (212 Fahr.) and then cooled for 20 minutes in a desiccator, and immediately tested in a machine for ascertaining the crushing strength in pounds per square inch, which is the measure of the cementing value of the rock, the average of five (5) determinations being taken. Rock which has a greater cementing value than ——— shall be rejected.
	7. FREQUENCY. Tests may be made from time to time at the option of the purchaser, and especially when new strata are being opened up for crushing into ballast.
	8. SELECTION OF SAMPLES. Each stratum of a quarry shall be tested separately and not averaged with any other stratum. (A.S.T.M.D. 75-22.)
	9. AVERAGING. For obtaining the values for physical tests, the average results on the numbers of specimens stated in the following table shall be taken:

Kind of Tests	Wt.	Percentage of Wear	Toughness	Cementing Value	Soundness
No. of Tests	5	5	5	.5	5

Requirements	Production Requirements
8. BREAKING. Stone for ballast shall be broken into fragments which range with fair uniformity between the size which will in any position pass through a 2½-in. ring and the size which will not pass through a ½-in. ring.	11. BREAKING. Stone for ballast shall be broken into fragments which range with fair uniformity between the size which will in any position pass through a two and one-half (2½) inch ring and the size which will not pass through a three-quarter (¾) inch ring.
9. TEST FOR SIZE. (Maximum) A Sample weighing not less than 150 lb. shall be taken from the ballast as loaded in the cars and placed in or on a screen	12. TEST FOR SIZE. (Maximum) A sample weighing not less than 150 lb. shall be taken from the ballast as loaded in the cars and placed in or on a screen

Present Specification	Proposed Specification
having round holes 2¾ in. in diameter. If a thorough agitation of the screen fails to pass through the screen 95% of the fragments, as determined by weight, the output from the plant shall be rejected until the fault has been corrected.	having round holes two and three-quarter (2¾) inches in diameter. If thorough agitation of the screen fails to pass through the screen 95% of the fragments, as determined by weight, the output from the plant shall be rejected until the fault has been corrected.
(Minimum) A sample weighing not less than 150 lb. shall be taken from the ballast as loaded in the cars; weighed carefully and placed in or on a suitable screen having round holes ½ in. in diameter. The screen shall then be agitated until all fragments which will pass through the screen have been eliminated. The fragments retained in the screen shall then be weighed and if the weight is less than 95% of the original weight of the sample the output of the plant shall be rejected until the fault is corrected.	(Minimum) A sample weighing not less than 150 lb. shall be taken from the ballast as loaded in the cars; weighed carefully and placed in or on a suitable screen having round holes three-quarter (¾) inch in diameter. The screen shall then be agitated until all fragments which pass through the screen have been eliminated. The fragments retained in the screen shall then be weighed and if the weight is less than 95% of the original weight of the sample, the output of the plant shall be rejected until the fault is corrected.
10. HANDLING. Broken stone for ballast must be delivered from the screens directly to the cars or to clean bins provided for the storage of the output of the crusher.	13. HANDLING. Broken stone for ballast must be delivered from the screens directly to the cars or to clean bins provided for the storage of the output of the crusher.
Ballast must be loaded into cars which are in good order and tight enough to prevent leakage and waste of material and are clean and free from sand, dirt, rubbish, or any other substance which would foul or damage the ballast material.	Ballast must be loaded into cars which are in good order and tight enough to prevent leakage and waste of material and are clean and free from sand, dirt, rubbish, or any other substance which would foul or damage the ballast material.
	14. CLEANING. The ballast shall be free from dirt, loam, dust or rubbish. When the rock is of such a nature that it does not become clean without preliminary scrubbing, a scrubbing machine shall be provided at the quarry.
	15. DEFECT FOUND AFTER DELIVERY. As it is impracticable to inspect all the ballast loaded in cars, carloads of defective material arriving at the site for unloading, and not previously inspected, shall be rejected and returned to the manufacturer, who must pay the freight charges both ways. If unloaded prior to discovery of defectiveness, payment without return of the rejected ballast shall be refunded to the manufacturer.
11. INSPECTION. Inspectors representing the purchaser shall have free entry to the works of the manufacturer at all times while the contract is being executed and shall have all reasonable facilities afforded them by the manufacturer to satisfy them that the ballast material is prepared and loaded in accordance with the specifications and contracts.	16. INSPECTION. Inspectors representing the purchaser shall have free entry to the work of the manufacturer at all times while the contract is being executed, and shall have all reasonable facilities afforded them by the manufacturer to satisfy them that the ballast is prepared and loaded in accordance with the specifications and contracts.
In case the inspection develops that the material which has been or is being loaded is not according to specifications, the inspector shall notify the manufacturer to stop further loading and to dispose of all cars under load with defective material.	In case the inspection develops that the material which has been or is being loaded is not according to specifications, the inspector shall notify the manufacturer to stop further loading and to dispose of all cars under load with defective material.
As the quarry deepens or is enlarged, further tests shall be made of the material whenever conditions indicate a change in the quality of the stone, or where in the judgment of the engineer for the company, a further test is advisable. Should such tests show that the stone fails to meet the provisions of these specifications, it shall not be used for the manufacture of ballast.	
12. MEASUREMENT. Ballast material may be reckoned in cubic yards or by tons, as expedient. Where ballast material is handled in cars, the yardage may be determined by weight, after ascertaining the weight per cubic yard of the particular stone in question by careful measurement and weighing of not less than five cars filled with the material, or the tonnage may be determined for subsequent cars by measurement and converting the yardage into tonnage by use of the weight per yard as determined above.	17. MEASUREMENT. Ballast material may be reckoned in cubic yards or by tons, as expedient. Where ballast material is handled in cars, the yardage may be determined by weight, after ascertaining the weight per cubic yard of the particular stone in question by careful measurement and weighing of not less than five cars filled with the material, or the tonnage may be determined for subsequent cars by measurement and converting the yardage into tonnage by the use of the weight per yard as determined above.

Note 1—High quality stone will have the following values:

	Limestone	Trap
Wt. per. cu. ft.	168	175
Toughness	10	15
Wear	5	3
Cementing quality	4 lb.	1 lb.

Note 2—Notation under toughness, wear and selection of samples refers to the Standard Methods of the American Society for Testing Materials.

Grinding Plant of the New York Feldspar Corporation at Rochester, N. Y.

THE plant of the New York Feldspar Corporation at Rochester, N. Y., was built in the winter of 1921. It grinds Canada spar and Godfrey spar, mined in the Adirondack section and shipped from DeKaulp Junction, N. Y.

The plant has a storage shed of about 25,000 tons capacity into which the spar is unloaded from cars by means of wheel barrows. The spar is wheeled from the shed to a conveyor that carries it to a 10x15-in. Worthington jaw crusher. From the crusher the material is elevated to a set of 76-in. Worthington rolls, that crush the material to ½-in. down to screenings. From the rolls it is carried up a 70-ft. elevator and emptied into a shuttle conveyor which carries the material to any one of four storage tanks, each tank having a capacity of 150 tons.

Each tank is equipped with a rocker feeder which feeds the material onto a conveyor leading to a 50-ft. elevator. The material goes from this elevator to a drier having a capacity of 10 tons. It is fed through the drier by a 9-in. screw to a 48-in. by 8-ft. Hardinge mill. The speed of the screw feed can be changed quickly, by means of a series of sliding sprocket wheels on a jack shaft, to give the mill the proper feed. The Hardinge mill is driven by a 75-hp. Westinghouse motor using a Link-Belt silent chain drive.

From the Hardinge mill the material is elevated to the second floor where it passes through a 3x4-ft., 10-mesh revolving screen. The tailings go back to the Hardinge mill through a return chute.

The screened material is taken to No. 2 drier by a 9-in. screw. Another 9-in. screw feeds from the drier to a 5x24-ft. straight pebble tube mill from which the material is taken to the second floor and discharged into a 9-in. return screw which carries it to a second pebble tube mill. After passing through this mill, the material is again elevated to the second floor where it is carried to the bagger or car by a 9-in. screw.

There are no tailings from the tube mills and the feed is controlled on them the same as on the Hardinge mill.

When the material is dry the tube mills will handle 2½ tons per hour, grinding Jasper grade. When grinding a coarser grade of product it is not necessary to double mill the material and the plant is arranged so that each mill can be fed separately from the drier.

Each tube mill is driven by 100-hp. General Electric Co. motors with Link-Belt drives. Two 14-hp. upright boilers furnish heat for the plant. The Northern Blower Co. recently installed a dust collector which takes care of practically all the dust. The plant is now running continuously on two twelve hour shifts.

Utah Plaster Company Plans New Mill

ANNOUNCEMENT has been made by the officers of the Mammoth Plaster and Cement Co., of Cedar City, Utah, that a new plaster mill of 100 tons capacity will be erected on the company's property in the canyon east of Cedar City. The company holds large gypsum deposits there which, it is said, are ideally adapted for casting plaster purposes. Assays and tests of this body of gypsum show 98% purity, it is claimed. The product has been tested by the Blue Diamond Cement Co., of Los Angeles, Calif., whose experts declare it to be one of the best deposits found in the west.

The decision to build the new mill followed the election of the following new officers and directors recently: E. E. Williams, president; John P. Fuller, vice president; L. W. Jones, F. J. Tolton, H. J. Doolittle, J. R. Robinson and Walter Michtell, directors. George A. Mitchell was elected secretary-treasurer by the new directors. All are residents of Cedar City, Utah.

Fine Grinding Limestone and Barytes

Plant of Thompson, Weinman & Co. of Cartersville, Ga., Which Makes Pigments, Whiting, Filler and Other Fine Mineral Products

THE fine grinding plant of Thompson, Weinman & Co., at Cartersville, Ga., produces finely ground limestone in many grades and ground barytes. The barytes comes from the company's own mines and washing plants which are a few miles out of Cartersville. A part of the limestone comes from the company's quarries in Sparta, Tenn., where it operates another grinding plant, and the remainder is bought. Some of this purchased material is marble.

But if the plant is not near the source of its supplies it is near to another important essential and that is cheap power. It stands on the site, and occupies some of the buildings, of an old flour mill on the bank of the Etawah river about a mile out of Cartersville. An old log and earth dam at this site always furnished power, even in the dry season. This dam has since been replaced by an excellent concrete structure and modern turbines and generators have taken the place of the old mill wheel.

The present plant is being rebuilt at the same time that it is being operated. A good concrete substructure has been placed under the old mill, a part at a time, and plans are laid for a steady course of improvement that will in time bring the buildings and surroundings into harmony with the equipment and the work that is being done.

Both Wet and Dry Grinding Are Practiced

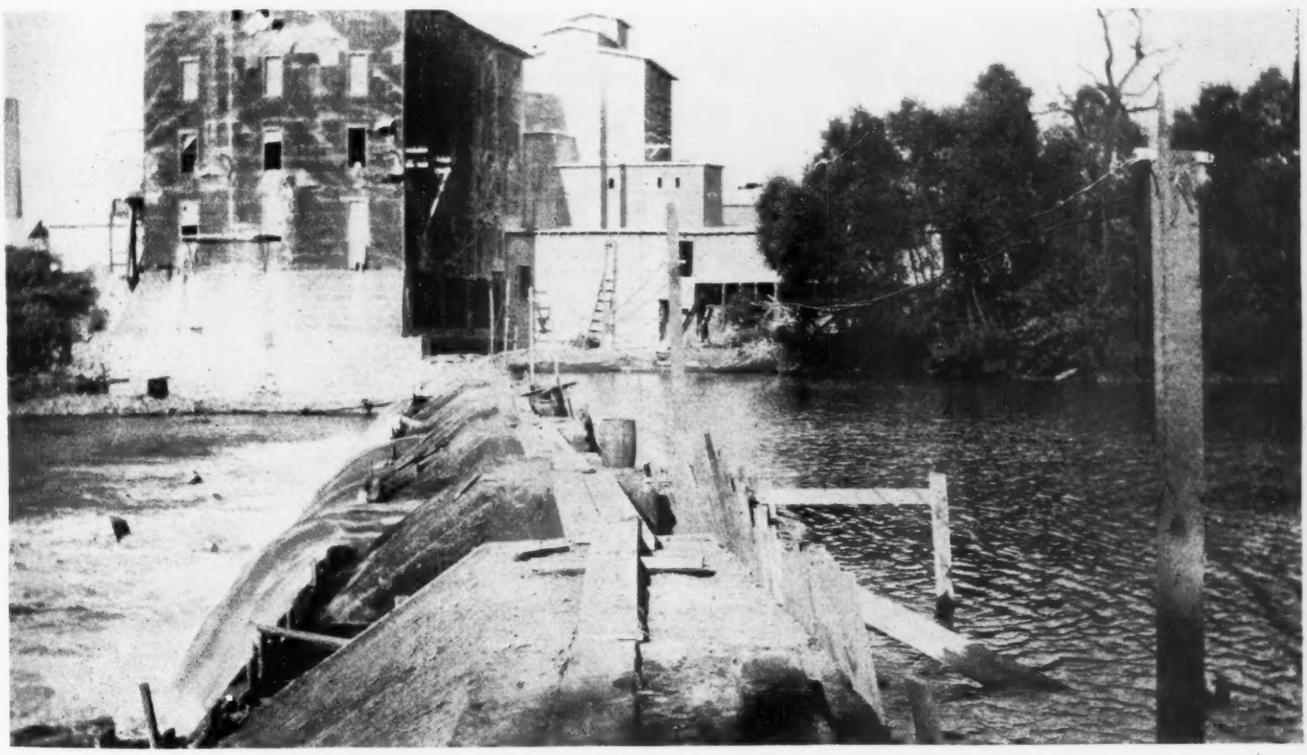
Both wet and dry grinding are practiced, the former by Raymond Mills in connection with a Raymond air separation system, the latter by Hardinge mills in closed circuit with cone classifiers of a special design. Dry grinding is used as much as possible, but it has not been found efficient in grinding the very finest material and for this the Hardinge mills grinding wet are employed.

In this very fine wet grinding the idea of mesh size has to be discarded altogether. All the product, whether wet or dry, has to pass a 325 mesh screen, but that only roughly expresses its fineness. The exact fineness is determined by the time it takes a given amount of the product to settle to a certain volume in a cylinder filled with water, a "suspension test," as it is called. Samples are constantly taken from the mills and tested in this way in order that the fineness shall correspond to the specifications for the particular product that is being made. For this fineness is often a most important characteristic. If the material ground is designed for use as a pigment the "covering" power is largely dependent on the fineness to which it is ground. The color is also influenced to some extent by the fineness of the product.

The Tramway

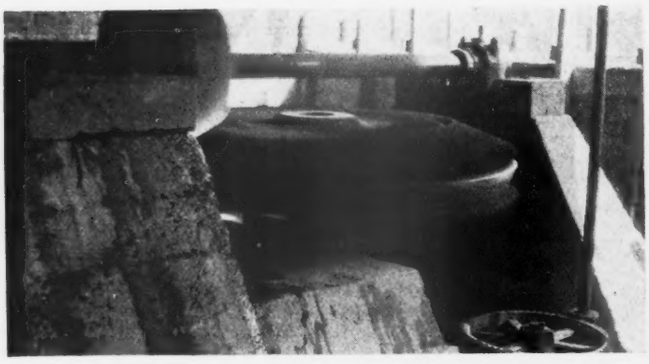
An interesting feature of this plant is the tramway by which the crude barytes is brought from the mines to the plant. It is 7200 ft. long and is of the "car" type and was made by the Interstate Equipment Corp. It is provided with automatic loading and dumping devices and a 15 hp. motor furnishes all the power necessary to drive it.

All the material to be ground is brought into the plant by railway cars and unloaded by hand. It goes to a No. 3 Austin crusher and then to an Allis-Chalmers crusher of the hammer mill



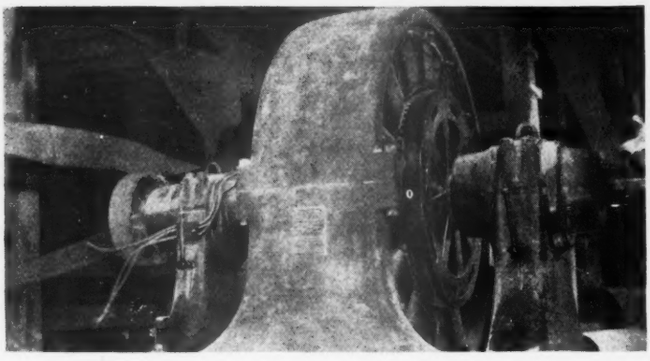
Plant of Thompson, Weinman & Co., taken while dam was being rebuilt

General view of the plant of Thompson, Weinman & Co.

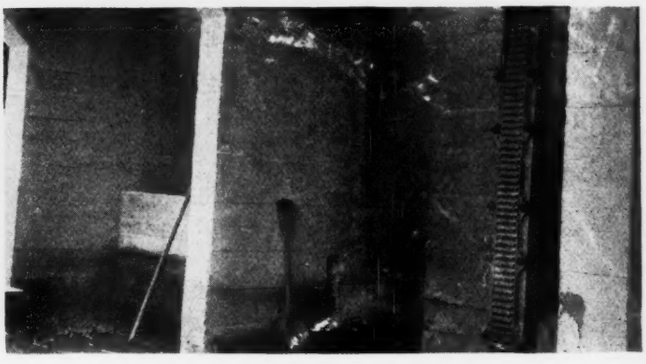


Gearing above turbines which drive mill plant

Dam and tramway span across the Etawah river



Generator connected to water wheels for driving distant units

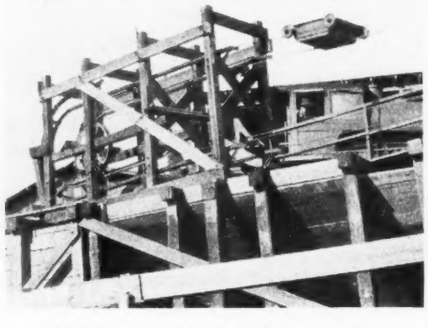


Gate house below the new concrete dam

type, if it is for the wet grinding plant. If it is for the Raymond mills it is broken either in a jaw crusher (made in Carterville, Mo.) or to another No. 3 Austin, sometimes one and sometimes the other being used, according to the nature of material. But in the end the material which has passed these primary crushers goes to overhead bins from which it is fed to the fine grinding machines.

Dry Grinding

In the dry grinding plant there are two 4-roller Raymond mills and the regular Raymond air separation system, which is installed on the floor above. These Raymond mills are driven directly by waterpower as they are situated in the same building as the turbines. Near them a 150 kw. Westinghouse generator is installed which drives the remote units. So the plant has the rather unusual combination of direct lineshaft drive for some machines and electric drive for others. It may be unusual but it is certainly logical to keep to the direct drive where conditions are such that it can be more easily and cheaply applied.



Discharge end of aerial tramway

Large Cone Classifiers

On the wet grinding side are two 8-ft. Hardinge mills, each of which has its own cone classifier or separator. These cones are very large in order to provide a large settling area so that the overflow shall contain nothing coarser than 300 mesh. Both cones were designed by G. A. Quasebarth, the superintendent of the plant. One is a plain cone. The other has a revolving shaft in the center with blades that keep the material from settling on the sides.

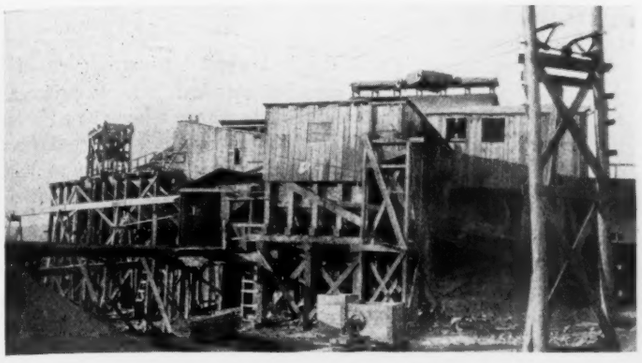
These cones do all that is expected of them so far as giving an overflow product of the desired fineness is concerned, but as the thickened pulp that is discharged at the apex to go back to the mill contains considerable moisture it

naturally follows that considerable material, fine enough to be discharged, goes back to the mill with it. This is not so serious a matter as it might be in some other kinds of grinding. Much of the material needs to be of such fineness that overgrinding is hardly possible, no matter how many times it is passed through the circuit. However, Mr. Quasebarth is designing a new form of cone from experimental data in which the thickened underflow is rewashed and any material fine enough is sent back to the cone to go out in the overflow.

Fine Screening

An interesting experiment, the particulars of which cannot be published as yet, was being carried on at this plant while the writer was present. It was nothing less than the separation of this very fine product by the use of a screen, a thing which would seem impossible at first sight. Although it was only an experiment the results were so good that it is expected that a commercial machine may be developed.

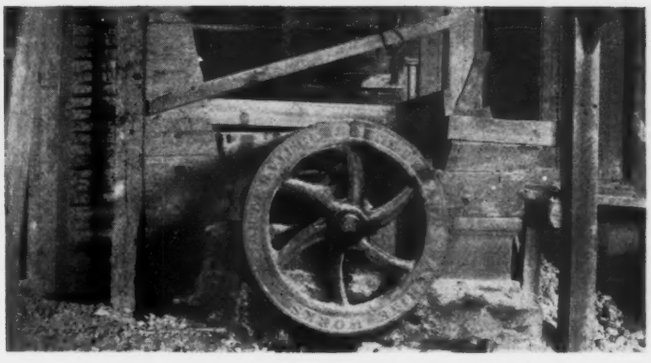
The cone overflow is thickened up in other cones and sent to the dryers. These are of a type which has been developed by Mr. Quasebarth after some years of experimenting and building different machines. Steam is employed to carry the heat to the wet material and careful tests on the input and output show that the heat in the steam is utilized 100% in evaporating water. The fuel efficiency compares favorably with direct heat dryers. As soon as arrangements have been made to patent certain details these dryers are to be placed on the market, for there are a number of industries in which an efficient indirect heat dryer is needed, especially for fine materials.



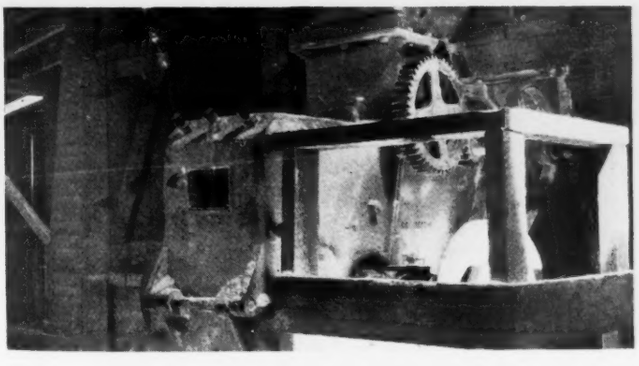
Barytes washing plant and start of aerial tramway to grinding plant

Receiving bins for tramway at grinding plant

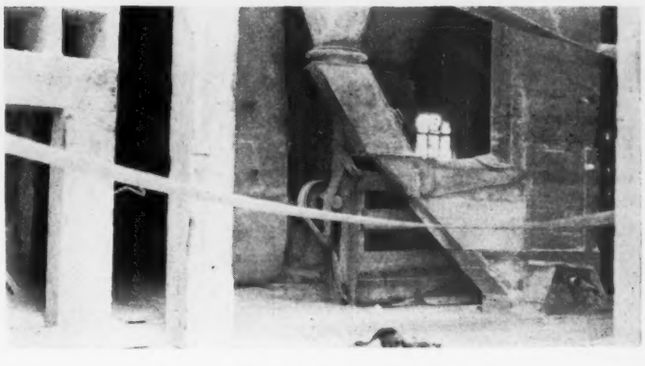
A corner of the warehouse showing material sacked for shipment



One of the primary crushers; the other is a gyratory



Hammer mill crusher used to prepare the rock for fine grinding



Part of the air separation system

Power Plant

In the power plant there are three Leffell turbines, each of 250 hp. The generator spoken of is belt driven from one of these. The turbines have each a separate gate and flume and the whole installation is very solidly made.

New Concrete Dam

The building of the new concrete dam was a most creditable piece of engineering work. It was built in 12 ft. sections,

Mills and lower part of classifying cones

that is a 12-ft. section of the old log and earth dam was taken out and replaced by a 12-ft. section of concrete, sheet piling being used to keep the water away from the section under construction. The entire replacing of the old dam by the new required only 50 days for completion.

Where Cement Costs $45 a Barrel

THERE appears to be an excellent opportunity to establish several cement plants in Persia. Wood is scarce and except in the Caspian provinces, it is used only for rafters and interior work of the better class homes. Stone is seldom used in building. The native bricks are usually sun-dried and always of a poor quality. The result is that practically all buildings are built of mud, with sometimes a mixture of soft, native cement.

The year ending March, 1922, there was imported 22,108,210 lb. of cement valued at $656,342 and in 1923 only 6,292,936 lb. valued at $182,183. Almost all came from Great Britain. The importations would have been much greater were it not for the great expense of inland transportation.

This inland transportation costs approximately three times the value of the cement landed at the coast, as all the large cities of Persia are situated inland. For instance the price of cement in Terehan is $0.12 per lb., whereas the cost of this according to the customs figures given above, was only $0.03 per lb.

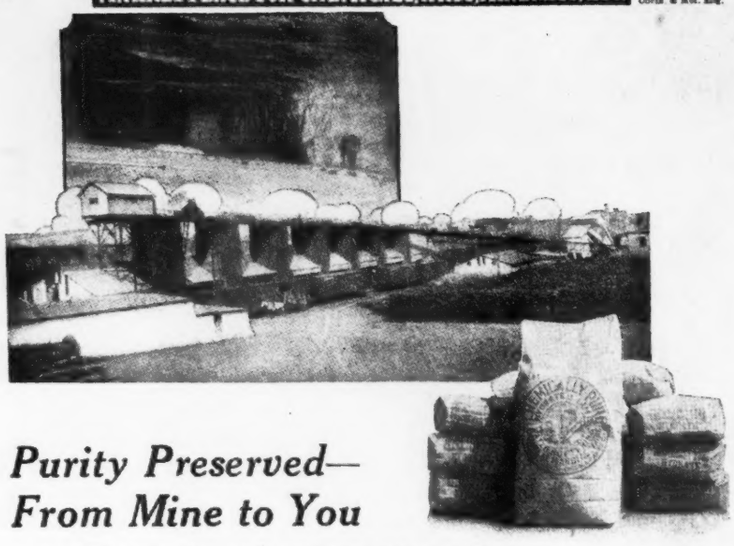
All of the requirements for such a plant are present—plenty of lime, clay, cheap labor, and in many places plenty of water and comparatively cheap fuel. It is estimated that cement could be produced for about $0.02 per lb. The retail price being $.12 there would appear to be the chance for a most profitable investment. The profits would arise, not only from the great saving in inland transportation, but in addition to the ocean transport, transshipping and unloading, the usual producer's and middleman's profit, and the 5 Krans per 100 batman ($0.12 per 100 lb.) import duty.

A plan for such a plant for the city of Terehan, was drawn up by the engineers of the Imperial Bank of Persia, but as that bank is not inclined to undertake industrial projects, no action has as yet been taken. The cost of such a plant has been estimated at about $400,000.—Report of Consul George Fuller, Terehan, Persia, to U. S. Department of Commerce.

Advertising Value of Limestone Mining

BELOW is a typical advertisement of a progressive chemical lime manufacturer that shows how limestone mining as a method of winning the raw-material is capitalized. Thus is added another advantage to limestone mining over and above some of the operating advantages which J. R. Thoenen, mining engineer, has pointed out in his series of articles current in ROCK PRODUCTS. The advertisement is also a good example of how operating methods can be used to good advantage in instructive advertising copy.

16 MARKET PLACE FOR CHEMICALS, ACIDS, MINERALS, ETC. Feb. 25, 1925 Chem. & Met. Eng.



Purity Preserved— From Mine to You

Marblehead safeguards of quality start right in at the mine, the natural source. Our big deposits of over 27 million tons are among the finest in the country, and the limestone is mined, not dug from an open pit—for the production of Marblehead *"Chemically Pure"* Hydrate. This pure, clean, raw material is well worth the extra precaution taken to preserve it intact.

Wood burning is another phase of our exceptional watchfulness, to avoid contamination from soot and gases. Every detail of our production is handled with this superlative care—every move under the scientific control of expert chemists—one organization from raw material to the final product delivered to you.

Hundreds of the most exacting users of lime in the chemical industries have standardized on Marblehead after having found that its purity, uniformity and high calcium content save money and speed up their processes.

Write for our booklets, of interest to every buyer.

Marblehead Lime Advantages
High calcium—over 97%
Remarkably uniform
Unusually pure
Keeps perfectly
Easy to handle
Ready to use
Six big plants
Quick shipments
Consulting service
Backed by 50 years experience

Marblehead Lime Company
Chicago, Ill. Hannibal, Mo. Kansas City, Mo.

MARBLEHEAD LIME PRODUCTS

In writing advertisers, use Chem & Met to introduce you

Example of how a progressive lime manufacturer "cashes in" on limestone mining

Factors Governing Lime Kiln Capacity

A Discussion of Kiln Design

By Victor J. Azbe
Consulting Engineer, St. Louis, Mo.

THE question of kiln capacity is by many considered quite mysterious but while it is true there are factors not yet definitely known, nevertheless there is sufficient information available to explain in part at least why some kilns make so much more lime than others.

The first and most important factor is the ability of the kiln to burn the fuel. If the kiln cannot burn the fuel, or sufficiently large amounts of fuel, it is evident that a proportionately large amount of lime will not be made. In this connection we must remember there is little direct relation between capacity and efficiency. There is a relation, it is true, but only an indirect one; so a kiln may be efficient and have small capacity and vice versa.

Fuel cannot be burned unless there is draft which draws in the air required to burn the fuel. The volatile matter of the coal can, of course, be gasified without air, but it cannot be burned, and so unless air is present there is no heat available to make lime. The fixed carbon portion of the fuel will not even gasify air. It will gasify, however, with insufficient air to carbon monoxide instead of to carbon dioxide, the product obtained when the right amount of air is used and when the greatest amount of heat is developed.

The conclusion would thus be that the kiln capacity is mainly a question of how much air can be introduced into the kiln; with no air no coal will be burned and no lime made. Much air will burn much coal and make much lime.

The assumption in all these arguments is, of course, that the air enters in the right place. If the air enters into the kiln where there is no fuel to burn, this air instead of helping the output will actually harm it.

Capacity Dependent on Draft

The kiln capacity is dependent entirely upon kiln draft. A kiln with poor draft will not make much lime. Anything that will help to improve the draft will increase the air input and if the fuel is there to burn, the lime will be made.

A lime kiln may be considered as a chimney, which it actually is. If there would be no stone or lime in the kiln and the same temperatures existed as are found during normal operation, the draft at the furnace in the kiln would be between .3 to .4 of an inch water pressure. The kiln charge, however, cuts this draft down so that often no draft is registered in the kiln at the furnace eyes.

The lower the stone in the kiln, the less will the kiln act as a kiln and the more as a stack. This is the reason why a kiln often will give a better output when the stone is low than when it is high. The resistance to the gas flow through the kiln is reduced and the draft increased. The portion of the kiln where there is no stone is a chimney but a rather inefficient type of chimney if the kiln is of open top type because in such cases there are down currents of air cooling the gas in the empty portion and since draft depends upon temperature difference inside and outside of a chimney or kiln, this cooling of gas reduces the draft.

Not Economical to Operate Kilns Low

To operate kilns low because better output may be obtained, is, however, uneconomical because the rock charged into the kiln under these conditions passes through the kiln too fast and so does also the gas from combustion and consequently considerable heat is wasted. This heat waste often is so great that while more coal is burned under these conditions, no more lime is made, the additional heat available escaping on top of the kiln.

It is not hard to discern that if better draft is desired, the kiln top should be equipped with stacks or with fans rather than operating kilns low of rock. In many cases, however, stacks and fans were tried without any apparent benefit but this is because some one thing was wrong and did not match into the system and there are many things that may be wrong and be responsible for poor kiln output even when the draft is good.

The question of furnace eye openings to the kiln is of importance. Evidently good draft in the kiln means little if that draft is not made available in the furnace where fuel is burned. The ideal is to have the total area of all eyes equal the kiln shaft area, but that is hardly possible, without changing the conventional kiln design very radically. In any case, the effort should be made to have these eyes as large as possible. In one case the writer measured seven hundredths of an inch draft on the kiln side of the eye and only one hundredth in the furnace, six-seventh being lost through the eye in friction due to either too small an opening or an opening obstructed by small rock or accumulated slag.

It is very fortunate that the fire creates its own draft, which is often sufficient, when it is operated at low rates of burning coal on the grate. The fuel bed on the grate is very hot and due to this draws in air for combustion, so sufficient air may be induced into the fuel bed for combustion even if there is no apparent draft in the furnace. But for this method to work satisfactorily, the grates must be amply large in area and not clogged with clinkers or with coal of the caking variety through which air cannot penetrate.

Forced Draft

In many cases forced draft is used, that is, air is forced under pressure into the ash pits under the grates, either by fans or steam air injectors. This method eliminates the grate from consideration since if coal is on the grate and the grate clear, very large amounts of fuel can be burned, provided the kiln is capable of disposing the gases. That is, if it has draft enough to draw the intensely heated and burning products of combustion through the eye into the kiln and up the kiln through the stone. If the kiln has not sufficient draft, the flame will back out through the firing door and the benefit derived from forced draft will be small or probably even negative. When the design is correct, forced draft is, however, of considerable benefit since then the various factors are properly co-related, the kiln draws well, but before it has a chance to develop a measurable draft, it is satisfied with gas from the furnace. In this way, large quantities of gas are handled without any apparent and measurable draft in the kiln.

Draft Gauge Should Show No Suction at Grate Level

A draft gauge, connected to the kiln so that it measures pressure in the shaft on the grate level under proper conditions and in properly designed installation, should show no suction (draft) and preferably should show pressure. The reading should be zero or plus. If the kiln has at this point a direct opening, the pressure can be roughly tested by blowing cigar smoke into the opening. If the smoke is drawn in, the kiln is not getting all the gas of combustion it can handle. If it is blown out, the kiln is handling all the gas it can and its capacity is

up to the limit and it cannot be further increased excepting by improving the draft by means of fans or chimney. As soon as the draft, however, is improved, the gauge or smoke will indicate suction which means that the kiln is not getting all the gas it can handle and then the blower under the grate or the gas burner should be so adjusted that more fuel is burned until the kiln suction disappears and again either zero or plus is registered.

Pilot Light to Show Draft

In instances where forced draft is used on kilns a 1½-in. opening should be made into the kiln and on the outside of this opening a pilot light should burn. When the pilot flame is drawn into the kiln, the production is less than that of which the kiln is capable, and when the flame is blown out the production is all of which the kiln is capable.

A certain kiln with which the writer is intimately acquainted is so designed that it operates with a rather high pressure in the kiln at the eyes (1/10" water pressure). As a consequence, the kiln output is 1,250 lbs. of lime per square foot of burning zone kiln shaft area. This kiln with a shaft of 4½x8 ft. has an output of 22½ tons of lime per day with no fans or chimney on top. This output is almost twice the output normally obtained from such kilns.

For maximum output kilns must be tight to the extent that no air will enter except where there is fuel to burn. Air entering the kiln at any other point will seriously harm production because it will load the kiln with a gas that has no value and will reduce the draft that should be available for handling the products of combustion. Further, the air entering the kiln through leaks absorbs heat and wastes it which makes it unavailable for making lime.

Summary

Summary of points discussed in this paper follows:

(1) Have kiln tight—allow no air to enter excepting where there is fuel to burn.

(2) Have eyes as large as are practically permitted so flame can enter freely into the kiln.

(3) Have some kind of forced draft apparatus, either fan or steam, that will give a mild pressure under the grates or at gas burner and thus make kiln draft available only for moving the gas through the kiln.

(4) Regulate conditions so that there is no suction in the kiln at the eyes, preferably a slight pressure. When this condition exists, the kiln is handling all the gas it can.

(5) For maximum output equip kiln tops with closed tops and either fans or chimney and thus increase the draft. If this is done, care should be taken that condition No. 4 is still maintained.

(6) Fire as regularly and often as possible so that there will not be too much excess air passing through kiln at times and probably at other times large amounts of incompletely burned gases.

Coming! Big Convention of the Lime Industry

THE seventh annual convention of the National Lime Association and the twenty-third annual meeting of American lime manufacturers will be held May 26 to 29, inclusive, at Briarcliff Lodge, Westchester County, New York.

The meeting will follow the lines of the annual meeting last year at White Sulpuhr Springs, W. Va., with the mornings and some of the evenings devoted to reports of work accomplished during the past year, results of felowships, as well as talks by well-known speakers on the subject of manufacturing problems. It is proposed to hold another Round Table Research Conference on one evening. The first of these conferences held last year.

Quarry of the Leicester Lime Corporation

Another view of the quarry of the Leicester Lime Corporation

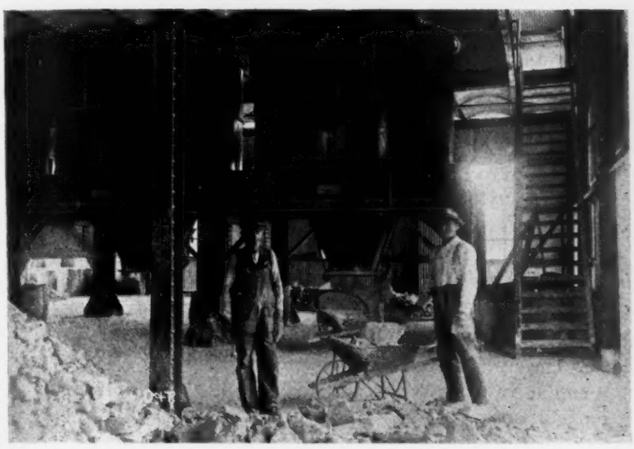
General view of kilns and hydrating plant

made for adding a fourth kiln.

The hydrating plant is equipped with a Sturtevant hammer mill, a Weber batch hydrator, a Raymond mill, Bates valve-bag packer and steel storage bins. Both lime and hydrate are a high grade white high-calcium product used in both the chemical and building trades.

The accompanying views give an idea of the character of the quarry operation and the plant location and equipment. Transportation from quarry to storage pile is by means of a cableway. From storage to kiln a cable-operated incline railway is used. The cableway bucket drops the stone into a hopper, and the kiln car is loaded by gravity on the track under the hopper. The car was specially designed by A. F. Mariglioni, secretary and general manager, and is entirely automatic in operation, so far as dumping is concerned, doing away with a laborer at the tops of the kilns.

The plant located on the main line of the Rutland R. R. John F. Linder, Linder and Meyer, Boston, Mass., is president, George von L. Meyer, vice-president and treasurer, and A. F. Moriglioni is general manager.



Drawing floor of lime kilns

Firing floor of lime kilns

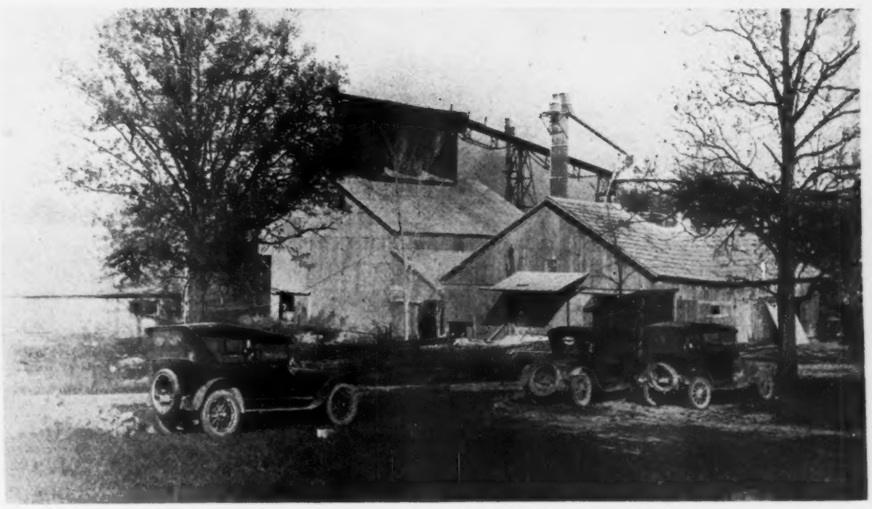
Leicester Lime Corporation's New Plant

ONE of the new lime plants of New England which has begun operation during the year past is that of the Leicester Lime Corporation near Branton, Vt. The site occupied by this plant contained one old kiln where lime had been burned for over 50 years.

The kilns are standard coal-fired shaft kilns, made and installed by Arnold and Weigel, Woodville, Ohio, and have a rated capacity on this high calcium stone of 12 tons per 24 hours. They are 11 ft. in diameter and the height above the cooling floor to the top of the cribbing is 57 ft. From cooling floor to firing floor is 16 ft.

The kilns are equipped with McGinty shaking grates. They are insulated with Armstrong cork insulation and Sil-O-Cel brick. The linings are Harbison Walker "Franklin Crown" brick.

The kilns are supported on steel columns and the building housing them is structural steel with corrugated metal siding and roof.



Another general view of the Leicester Lime Corporation's new plant

The firing floor is reinforced concrete on steel floor beams. The cooling floor also of course is concrete. The steel coolers have the swinging type draw shears. Provision is

The Highway Materials Problem

"The Economic Selection of Road-Building Materials" —The Atttiude of State Highway Officials Toward Producers of Cement, Crushed Stone, Sand and Gravel

IT doubtless often appears to producers of crushed stone, gravel, sand and slag that highway officials, while constantly asking and demanding a higher grade of aggregates from producers of commercial materials, are very lenient in accepting materials from side-of-the-road quarries and pits, the opening of which are sometimes purposely encouraged by them. It has so appeared to the editors, and wishing a little first-hand information we wrote to the state highway commissioners and the state highway engineers of the various states the following letter:

Dear Sir:

A controversy arose during 1924 between the state highway department of at least one of our states and the producers of highway materials. The highway officials evidently took the point of view that the producers were "robbers" and that the state should go to any limit to avoid buying materials from them.

The producers took the point of view that the highway officials were high handed and arbitrary, and that they had reached a conclusion in regard to current prices which would not have been justified by a thoroughgoing study of all the factors involved.

Instead of meeting each other on common ground and doing business as business men, these two parties have been antagonistic; the state officials have felt called upon to finance inexperienced producers, whose products have subsequently been rejected, and much bitterness and unnecessary expense has been incurred all along the line.

It always has seemed to us that the interests of all concerned were the same and that a lack of understanding and appreciation of each other's viewpoint has been very costly to all concerned.

If you, as a highway official, want to promote the use of good materials in highway building, you must encourage the production of good materials—washed and screened sand and gravel for example, instead of side-of-the-road material.

I would like to get from you an honest and straightforward expression of opinion of your attitude toward the producer of highway construction materials. This will be held confidential, unless you wish to be quoted, and only a general concensus of the opinions of all the various state highway officials will be published.

We believe we will be doing a good service to the cause of efficiency and better quality in public works if we are able to lay before our readers—cement manufacturers and stone, sand and gravel producers—some of their shortcomings in their dealings with state highway officials, as seen by state highway officials.

Do you honestly believe they charge unfair prices? Do they use unfair methods? Should the commercial washed sand and gravel plant and the crushed stone plant involving investments running into hundreds of thousands of dollars be discouraged by the giving of a season's business to a "fly-by-night" producer? Is there any better way of getting cheaper and better materials than to give producers a chance to operate their plants at maximum capacity, since cost is almost wholly a matter of the percentage of plant capacity produced? Is it your fault or the producer's fault when production is cut and prices increased because business is given to small temporary producers?

We are probably entering an unprecedented period of public-works construction and a better mutual understanding ought to be helpful all around. Please write frankly just how you feel about this situation and we will pass it on to the producer just as frankly and on our own responsibility.

Sincerely yours,
ROCK PRODUCTS.

"The Economic Selection of Road-Building Materials"

Before discussing the replies to this letter it is well to get a clear understanding of what highway engineers mean by "the economic selection of road-building materials." This is best contained in a paper of that title by W. E. Hawkins, maintenance engineer of the North Carolina State Highway Commission, presented at the fourth annual meeting of the Highway Research Board at Washington, D. C., last December. We quote extracts from Mr. Hawkins' paper as follows:

"The problem of the engineer is to select a type of construction that will utilize to the best advantage any available local material.

"To secure the most economical construction on any proposed work investigation should be made to determine if satisfactory local material is available. Material survey parties should be sent into the field to locate all local materials which could be used advantageously in the construction work. In this way local deposits of material will be found that will afford an economic selection.

"Some parts of the country have an adequate and well distributed supply of materials suitable for concrete roads. Excellent deposits of coarse and fine aggregate can be found in many localities. Other sections are not so fortunate and are therefore compelled to use material which will not conform to the commonly accepted standards. It is, therefore, the duty of the engineer to devise some means by which these materials may be used to the best advantage.

"Some consideration must be given the methods of proportioning the material, as well as the selection. If materials of this class of construction are to be economically selected it becomes necessary to depart from the standard tests which have been in vogue for some time. Tests have shown that portland cement varies in quality, as cement from the same mill in certain districts varies almost as much as that from several mills. These conditions should be corrected and the product made standard.

"With reference to fine aggregate there is considerable opportunity to work out the economic use of local aggregate, provided the laboratory is suitably equipped to handle this work and afford intelligent direction and supervision over each given deposit. North Carolina, for instance, in general possesses what would be ordinarily claimed as an inferior grade of fine aggregates. Deposits are found somewhat scattered throughout the state which vary considerably in quality when tested by standard test methods. The economic use of this material was made possible by the abandonment of the present standard test for sand and a new method devised. This method consisted of testing each sand in concrete and comparing the results obtained with standard Ottawa sand tested under the same conditions. The coarse aggregate was standardized for this work and the amount of cement and coarse aggregate in both cases were kept constant per unit volume of concrete. The test itself is practically no more expensive than the present standard tests, but it was found by this test that many local sands were made available for use and made concrete as strong as other materials which might pass the standard requirements by considerable margin.

"A survey of the local sand deposit situation in North Carolina indicated that but 18% of the local deposits would pass the standard test for sand, while the adoption of the new test method allowed over 90% of the deposits to be utilized. An interesting feature from the economic end was that while certain sands of finer gradation might not come up to the

desired strength at the 7 or 28 day period, tests at 3 months to 1 year would in practically all cases show equivalent strength.

"The economic selection of coarse aggregate is a very important matter. It has been found by tests that it is necessary to decrease the maximum size of coarse aggregate if we are to secure economic concrete. Experiments also show that large sizes of coarse aggregate render the slab much more susceptible to impact stresses than when smaller sizes are used, and that the size of the coarse aggregate should be considered in relation to the thickness of the slab, and by the adjustment of sizes of coarse aggregate we find that relatively inferior local aggregate can be used instead of importing stone, which when tested under similar conditions shows a higher strength.

"Each state has its own detail problem in regard to an economic selection of road building material. Highway research if practicably applied will solve many of these problems and be helpful in the expenditure of available funds for road building purposes. It is necessary that the research work be carried on in a systematic manner so that the results derived may be of assistance to other states in their road building programs."

Attitude of Highway Officials

The replies of highway officials to the letter quoted at the beginning of this article were more frank and open than we had expected. A reading of them leaves no question that state highway officials are nearly universally eager to be fair to all concerned. They are in a difficult position and deserve and should have the earnest and whole-hearted cooperation of the material men with whom they do business.

We quote at random anonymously some of the opinions expressed by chairmen of state highway commissions, and state highway chief engineers:

State Should Encourage Well-Directed Enterprise

"I can best answer your question for an honest and straightforward expression of opinion of our attitude toward the producers of highway construction materials when I state that in preference to operating quarries and performing other activities along that line to secure construction materials, we have made it a business to assist in developing private enterprise to carry on that activity for us. We have two reasons for this move. The first is that the business of producing construction materials is a good business to have in any locality, and it assists in making any community self-supporting. It also brings in a certain revenue, as it is taxable property, and thus assists in stabilizing highway and other state finances. It also, and this last may be a selfish reason, relieves us from handling a commodity until it is ready for construction work, and thereby reduces our worries and cares. Second, we feel that under normal conditions private enterprise can produce construction materials at a less cost, even when reasonable profit is added, than state materials can be produced under public control.

"We work almost exclusively by contract, and we find that if we can even contract the materials from private producers that it is a saving in construction cost."

Should Not Tamper With Present System

"This department feels that the present scheme of production of road materials represents the result of many years of evolution and should not arbitrarily be tampered with. The demand for more materials, and better materials, has always been met by increased efforts and expansion on the part of commercial producers. We see no reason to believe that future demands will not be satisfactorily met by the men familiar with the business. We feel that the function of an engineering department is to do engineering work, to leave construction to contractors, and material production to material producers. We feel that we have troubles of our own in keeping abreast of modern engineering practice, with design, administration, supervision, etc., without shouldering the burden of construction and material production which we are not fitted by training to carry. The present department of this states does not entertain any socialistic scheme of state material production, or of state control of material production other than the insurance of quality and service.

"Our dealings in the past few years with material producers have been pleasant. Such minor disagreements as have come up have been adjusted without sacrifice of quality or service on our part, and I think without hard feelings on the part of the producers. We have had no material scandals, no unsatisfactory materials, no unreasonably priced materials, no stifling of competition, no unpleasant advertising, and do not expect any.

* * *

"I am in entire sympathy with your campaign for good materials produced by responsible producers and for more sympathy and understanding between all of us who owe our living to the public demand for increased facilities."

* * *

Local Materials Have Not Always Resulted in True Economy

"In the beginning it should be said that the public official is confronted with the duty of practicing the necessary economy to give the people that pay the bill, namely, the taxpayers and citizens of the state, the most for their money. There are numerous cases where the use of local materials, which can be produced by the contractors, will be the most economical proposition. However, I am frank to admit that in many cases this has not resulted in the economy anticipated due to several factors. Among these are the inability to produce the necessary quantity required to obtain adequate progress on construction, and in general the quality of the material, both in regard to grading and cleanliness is not up to the standard produced by many commercial plants. There have been cases in this state where it has been possible for the producers to combine so as to hold up the price of material, but in general this department has no complaint in this respect. Of course, we are desirous of encouraging the commercial producers of road materials so that an ample supply will be available at all times, and competition may be such so as to insure a reasonable price to the contractor and to the state."

"Unfortunate Experience With Local Materials"

"(a) I do not believe the producers of stone, sand and coarse aggregate charge unfair prices.

"(b) I do not believe that they use unfair methods.

"(c) The producers of these materials should not be discouraged by giving business to 'fly-by-night' producers or uncertain contractors, who promise well but usually fail.

"(d) I have no doubt but that it is the fault of state highway departments when production is cut and prices increased, on account of the fact that in many cases the business is given to small temporary producers.

"Summarizing the above, would say that I have been on the state highway board from the beginning of the work in this state, the last four years having been chairman. We have had a very unfortunate experience in our efforts to obtain local materials from local contractors, and in two cases, quarry contracts which promised well have been utter failures, resulting in great annoyance and great loss.

"We have had all the experience along this line that we desire, and from now on unquestionably these materials will be obtained from established firms at fair prices."

Good Results Only by Full Co-operation

"Our state highway department has always considered that good results in construction can only be obtained when there is full co-operation between the various factors involved. We have always been willing to meet both the producers of construction materials and contractors on common ground.

"The producer is entitled to a fair return on his investment, and economical con-

struction largely depends on a dependable source of supply of satisfactory construction materials.

"We in no way care to encourage monopoly, but do not believe that the large reliable producers should be discouraged by unreliable competition. Before placing any contract for large quantities of material, the capacity of the producing plant and ability of the low bidder to supply the material, as required by the contract, should be carefully considered.

"The chief difficulty, we encounter, is mainly due to lack of uniformity in the requirements of the specifications in use throughout the state. We find it difficult at times to get satisfactory material from any source, for as long as the producer can market an inferior quality of material, he is averse to taking the necessary precautions to keep his material up to our requirements."

Must Use Local Materials

"In your letter you state that the highway officials in one state 'evidently took the point of view that the producers were robbers and that the state should go to any limit to avoid buying materials from them.' This has not been the attitude of our commission. Instead our position has been as follows:

"1. We have not raised any question regarding the plant price of concrete aggregate.

"2. A large proportion of our mileage is surfaced with other materials than concrete. For this mileage we use the best material available locally. In but a small number of cases has it been necessary to ship in material. The interest of the public demands that this policy be continued and we assume from your letter that this question is not involved in the discussion.

"3. For the relatively small mileage of concrete paving we have encouraged the development of local pits in all cases where the saving in freight, unloading charges, and truck haul made the use of local material justifiable from the economic standpoint. The producer at a local pit is required to meet the specifications. The material must be screened and clean. In cases where there is doubt regarding the quality of the local material and where there is not a clear-cut opportunity for saving, local material is not used. In the section of the state where nearly all our concrete highways have been built, there is a great abundance of excellent well distributed gravel. There is no difference in origin or quality between the gravel at a commercial pit and that at a local pit. If properly equipped and operated, the local pit produces as good aggregate as does the commercial pit.

"The contractor who develops a local deposit is in fact operating a commercial plant. He chooses to use local material because he sees an opportunity to increase his total profit by an additional operation. He sells the product of his plant to the state or county rather than aggregate purchased from a regular commercial plant.

"The following summary answers the questions in your letter: We do not believe the commercial producers charge unfair prices or use unfair methods. In a state as abundantly supplied with local gravel as is ours we believe that we should be remiss in our duty as public officials if we did not use equally good local material when it can be delivered on the job at a cost appreciably lower than that for rail-hauled aggregate. If local plants increase to the point where the demand for the product of the commercial plants falls off, the operation of economic laws must bring adjustment. The overhead per ton will increase and the selling price may go up. This increase, however, will affect only those places where local material is not available and these are few in the concrete paving area of our state. We are concerned with the proposition of cutting down the cost of the delivered aggregate. A large factor in this cost is transportation, a factor that we have been able to reduce by the use of local material. For rail hauls of 5 to 100 miles the freight cost (December, 1923) varies from $2100 to $4500 per mile of paving. Add to the freight cost the attendant unloading charge and any increase in trucking cost, and the total forms a surprisingly large percentage of the cost of a mile of paving."

Really Small Amount of Local Material Used

"I would say that in our state there is usually accord between the material producers and the state highway department. There is no inclination on the part of the state highway department to view the material producers as 'robbers.' However, we do feel that whenever local material is available that the department should use same, if the material will meet state specifications for this type of material. At a rough guess, however, I would state that not to exceed 8% of our work is being done with local material."

Is a Local Problem

"After a careful reading of your statement I have concluded that it is too general in its character for a definite statement, and I would prefer not to discuss the matter at this time. I might add, however, that this department is not having any difficulty with the producers of highway material, and I am afraid that perhaps your conclusions may be drawn from purely local situations that would not apply generally to the various states."

Specification and Freight-Rates Govern

"I believe that the producers of highway materials have acted in an honest, straightforward manner with the road commission of this state and contractors doing business in this state. This opinion is expressed as a personal opinion and, of course, there may be some exceptions. The state road commission insists upon all materials being tested by our material engineers so that whether a producer may be termed 'a fly-by-night producer' or a 'commercial producer,' the requirements for materials are identical and these requirements must be met before materials may be used in our highway construction.

"It must also be understood that in many instances freight rates govern the basis of competition, so that when commercial producers cannot quote a price to compete with a local producer, the loss of business cannot be attributed to any high-handed dealings of road commissions or unfair prices or unfair methods of producers. Generally, however, it is believed that in our state at least the relations between the highway commission and the producers have been pleasant."

Low Bidder Must Get Contract

"All of our materials are purchased on competitive bids. We have attempted to draft our specifications on materials, in such a manner that they will meet the requirements of good engineering practice, for the purpose for which they are to be used. It is our policy to award the contract to the firm who places the low bid providing an investigation shows that they are in a position to make satisfactory deliveries.

"We are not particularly concerned with the amount of money the producer has invested in plants, etc., provided his material meets the requirements of the specifications, and he is able to make proper deliveries. We have never had any serious trouble to my knowledge, with producers of materials in our state, relative either to price or the materials meeting the specifications.

"On the whole, we have received splendid co-operation from the material producers and have found them fair."

Only the Quality Governs

"Our attitude in the matter would be that any producer furnishing acceptable material, in acceptable quantities, would be looked upon with equal favor to any other producer. The quality of material is clearly stated in our specifications, insuring that the producer would bid on an equal basis.

"Personally, I do not see the grounds for the difference, as it would appear that by standardization of methods that it would have been prevented."

Co-operates Profitably with Material Men's Associations

"Most of our contact with material people has been through the contractors,

as most of our work is being done by contractors. The state has on one project purchased cement, and in the past possibly other material at different times, but the general rule is to leave all of this to the contractors.

"During my term of office I have tried to develop relations with contractors, material interests, bonding companies and others along broad business-like lines; and as a rule I find that business interests are quite willing to meet you on this basis.

"I have recently had the consulting engineer of one of the big material associations with our engineers, going over the different projects and conferring and suggesting as to how we might improve our methods, in order to get the very best results with that particular material. I hope from time to time to do the same with other similar associations. I think that this is one way that material men can improve radically the work being done and benefit appreciably in consequence.

"I refer to this briefly as indicating one of many things that we are developing. There is, of course, a wide field for different materials and will doubtless continue to be increasing demand as we develop our road problem. The problem is big enough to demand the best in all of us in order to secure satisfactory results."

Material from Cheapest Source

"We have sufficient competition to keep down unfair prices. I am of the opinion that at times unfair methods are used, but believe that this is due to the individual and not to the entire body of producers. I know of no way in which washed sand and gravel plants can be protected from what you term 'fly-by-night' producers. We have adopted the policy of securing the material that meets our specifications from the cheapest source. You will realize that any man handling public funds must first of all protect himself against any charge of favoritism to any particular producer or set of producers, and this charge would immediately be raised if the work was not awarded to the man having the lowest price for products which will meet our specifications."

No State Justified in Financing Producers

"I am not in favor of giving any concern the business unless they can furnish it as cheaply or cheaper than some other concern. I presume that you realize that public officials are public servants and are subject to criticism at all times and that would especially be true if they did not buy the materials through open competition.

"We do not finance any firm or concern in any way nor do we think that any state would be justified in doing anything of that kind. As to prices charged in your part of the United States, we are not familiar with them; we do know, however, that the cement is controlled by a cement trust. As to whether or not the price is unreasonable, that would be very hard for anyone on the outside to say. We have about three cement plants in our state that are controlled by the same corporation so that competition is shut out as far as that is concerned, in my opinion."

Use Material Men's Organizations to Raise Standards

"Under the present administration, our state highway commission has adopted the policy of requiring the contractors to furnish materials so that the state is not directly concerned nor does it come in direct contact with the material producers.

"In this state as well as in eastern states, the rock, sand and gravel producers are pretty well organized and are represented in general by an individual or organization which acts as a clearing house for co-ordinating their business. We make it a habit to confer with not only the material men who are producing rock, sand and gravel for highway construction but also with the county and city officials to secure, as far as possible, standardization in our requirements.

"The specifications require a high grade of material at all times but before making changes of any kind it is our custom to confer with the producing companies in order that there shall not be any drastic change in the machinery or methods required.

"If it is pointed out to us that a certain large plant has recently made an expensive change, we are willing to defer our proposed improvement until such time as is more convenient. However, in general, through this close co-operation, the plants are all in about the same condition of efficiency, that is, that nearly all have washing plants, bin storage, the possibility of furnishing material either mixed or in separate sizes as we desire it, and with the gradings of both sand and rock such as we find necessary for our work.

"There have been cases where there has been an attempt on the part of certain producers to control the entire market or force the state to take all of their material, but these attempts have, of course, been unprofitable. Our attitude is that where first-class plants involving investments running into large sums have been constructed and the producers are attempting to co-operate with us in every way, they should be protected as much as possible and as they have a large business investment, the state should not be in the business of competing with them so long as they give us fair prices. ***We feel that for us to allow a producer to charge an unfair price is a reflection on our ability to judge what a fair price is or to make a proper analysis of production costs.*** We feel perfectly competent to make an analysis at any time of any plant and have plenty of data on which to arrive at a proper conclusion of what the price should be. While there may be cases in which the state might do the work more cheaply in a long run, we believe that the producers are entitled to the business and can, in general, give us better service than we could furnish ourselves.

"The standard for our material is so high that producers who are inadequately equipped are automatically forced out of business before they try to begin delivery on state work."

Misunderstandings Because of Lack of Business Principles

"I agree with the statement contained in your letter that a good deal of the misunderstanding existing between state highway officials and material men are due to the fact that their relations have not been entirely on business principles, and, as you say, they have not met on a common ground.

"I am glad to advise that the relations existing between our state highway commission and cement manufacturers, and stone and sand and gravel producers have been agreeable, and I feel sure that they will agree with me that our state highway commission has been fair.

"All differences as to price and quality have been fairly threshed out on a business basis, and we have gotten full value on road building materials for the taxpayers of our state from the trade. We have never paid more than the market and in a good many instances have been able to purchase under the market. Our system of competitive bidding and publicity has been of mutual benefit.

"It is our policy to use local materials when it is clearly to the advantage of the state, price and quality considered. The 'fly-by-night' producer has no more place in road building than in any other industry.

"The producer's costs based on capacity production have influenced us in determining whether or not the state's interests are best served. Honest quality local production under the present high freight rates have in some instances influenced our purchases and worked to the dissatisfaction of commercial producers.

"We have handled our problems separately on their merits without prejudice or favor, and as before stated, I believe that our relations have been mutually satisfactory."

Producers Can Help by Co-ordinating Material Supplies

"It is the policy of this department to co-operate with the producers of material by giving as much publicity as possible to our road improvement program, and also to let contracts in such a way that the material supplies can be used to the best advantage.

"We are not conscious of any lack of co-operation on the part of material producers, but feel certain that some improvement can be made in co-ordinating the material supply with the construction projects. In other words, we have noticed that crushed stone is frequently shipped by one producer from the eastern to the western part of the state, while at the same time producers in the western part of the state are shipping to projects in the east. This apparently comes about through the practice of producers to vary the price so as to make allowance for carrying freight rates. I presume such a practice is justified at present, but we are hoping to work out better co-ordination so that the various producers will be shipping their materials to the most convenient points and there will be small occasion for the varying prices now being charged."

Businesslike Methods Pay

"Practically all the material being used in the construction of hard surfaced roads in this state is purchased from some producing company, as we do not operate any quarries of any kind. The major portion of our work is done by contractors, and of course it is up to them to use materials meeting the specifications for the work to be done, over which this department does not exercise any control. In some instances the department furnishes the material to the contractor, and in this case we advertise for bids and such companies as are interested submit bids and the contract is awarded to the lowest and best bidder. Not, however, always to the lowest bidder, as sometimes he would not be able to meet the requirements as to production.

"The material business in this state seems to be on a competitive basis, and I don't know that we have any serious complaint to make against any of the companies furnishing road materials. It is a matter, of course, in which we have our differences, and sometimes have to use more or less drastic measures, but this would be the case regardless of whom you might be dealing, I think, where the volume is such as we have to handle. The producers of rock materials coming into this state or being manufactured in this state are well acquainted with our requirements and methods, and when material is received on the job which does not meet the specifications the same is rejected, and the companies have always cooperated with us in making such correction as was necessary.

"Sometimes we feel that some of the companies possibly charge higher prices for materials than is justifiable, but, of course, this is subject to discussion and it is only our views we are stating."

State Has to Promote Plant to Get Materials

"It has been my pleasure during the last twenty years of highway experience to come in contact with the head officials of practically every highway department in the United States. I think they all rank high as business men, and their judgment should not be criticized as has been done in the past by a few periodical writers who are not fully informed. Our state has five commissioners who rank as high as any business men in the country and I am willing to rely upon their judgment as to what is good business for the state, and also the ethics of good business.

"In no case has our state highway commission indicated nor made statements to the effect that the producers are robbers. This commission has always worked on the theory of building roads at the least possible cost. I believe this policy prevails among most of the states of the union. I think most of the states also investigate the facts involved before taking any steps. The material conditions were carefully investigated before any action was taken. This is borne out by the fact that last season we were unable to get crushed rock from rock producers to supply our demand. Our 1925 program will be curtailed on account of not being able to get sufficient crushed rock even with the two material plants which the state has assisted financially and the other contracts which it has made to establish new producing plants.

"We are not aware of any fly-by-night producers, to whom you refer. All producers must at sometime make a start. We hope to get more producers to make a start in our state, because we must have them to build the road system of this state. In many cases side-of-the-road material plants are very economical and save the state tremendous sums of money. There is no reason in the world why the state should not take advantage of every opportunity to build roads at the minimum cost.

"We are going to be compelled to open up a large number of side-of-the-road quarries to build our state road system, and we are further going to have to do something to get the old time producers of this state to see their opportunity. We are in need of crushed rock far in excess of the present supply.

"If through your periodical you can do anything to inspire some of the producers to keep pace with the public sentiment, you will have done a good work."

Local Materials Too Plentiful—Must Be Used

"This department has no quarrel nor fight with the commercial gravel and stone producers in this state. It must be appreciated, however, that we are expending public funds and we believe it our duty to secure the greatest possible benefit to the public in expending these funds for highway construction. In other words, service and quality being equal, we are obligated to purchase road building materials at the lowest net price possible.

"Further, in considering this matter as far as it concerns our state it should be particularly noted that, in general, the state abounds with gravel deposits and it would not seem logical and would not be economical to make long rail shipments of sand and gravel into a locality where there was a sufficient amount of acceptable local sand and gravel waiting for development. This department has not gone into the gravel producing business at all but we feel that if some private party desires to make an investment to put in a local washing and screening plant that can produce special specification material at less price than could be secured from an established commercial plant, plus freight, that the business should be given for local material.

"This department has endeavored, as far as possible, to award contracts in the fall and winter so as to make it possible for the successful bidders to place orders for their materials early in the season, and we have, from time to time, sent out letters to these contractors urging that they stock materials during the early spring months. We believe that this has been of distinct advantage to the commercial gravel and stone producers and we believe that they appreciate our co-operation in this matter.

"I desire to state again that we have no quarrel with the commercial gravel producers and, in general, we have been able to make satisfactory price agreements with them, but that we do not feel that it would be proper for us, in expending public funds, to purchase gravel where excessive freight rates would prevail, when local materials could be obtained, in satisfactory quality and quantities, at a material saving in price."

Conclusions

We have made no attempt in the foregoing quotations to select either favorable or unfavorable comment. We have put them down as the letters were picked up. Nor have we made any attempt to digest the letters as we originally intended. We believe far more good will be derived from reading them in the exact words of the writer.

A study of these ought to furnish the reader with a fair comprehension of the psychology of state highway officials. Such a study ought to convince the reader —if he is a producer—that in dealing with honest public officials he has a more than ordinary responsibility to preserve a fair and open mind. A full recognition of the difficulties of state highway officials in their business dealings and their position as guardians of the public welfare, and an earnest desire and real effort to make their paths easier, will gain more recognition and prestige for the producers of rock products, than destructive criticism.

Crushing Quartzite to Aggregate and Ballast

Operation of the Rockville Quarry Company, Near Harrisburg, Penn., Which Works a Hard Re-Silicified Sandstone for Fine and Coarse Concrete Material

JUST outside the city limits of Harrisburg, Penn., is the plant and quarry of the Rockville Quarry Co. It is one of the few plants in this section that does not crush limestone, the rock being a hard re-silicified sandstone or quartzite. It is crushed to make fine and coarse concrete aggregate, road dressing, and railroad ballast. Shipments are made by truck to Harrisburg and by rail to other points.

The quarry is peculiar in that the bedding planes are vertical. There are two ledges worked and these are divided from one another by a ledge of hard shale. These ledges are each about 100 ft. wide and the ledge between them is about 100 ft. wide. Fossils, shells and the like are often found in this rock and determine it to be of the Silurian age, according to the Pennsylvania geological survey.

Horizontal Holes Used in the Quarry Face 70 to 80 Ft. High

The quarry face is 75 to 80 ft. high and the rock is brought down by drilling into the side of the face ("snake holing"), one or two vertical holes being put in from above to act as "relievers." Holes are put down with Ingersoll tripod drills and jackhammers are used in block holing. Owing to the hardness of the rock the drills lose the gage rapidly and it is customary to start with a 4-in. bit when a 20-ft. hole is to be drilled. Dupont 40% powder is used in blasting.

The rock is loaded into 2-ton side dump cars made by the Biel Iron Works of Reading, Penn. These cars are pushed by hand the short distance between the quarry face and the primary crusher.

Close-up of screening plant. Note elevator that lifts oversize to conveyor belt

This crusher is a Kennedy-Van Saun No. 5 gearless driven by a 30 hp. General Electric motor. It is set so that the mouth is a short distance below the quarry floor and the space between the floor and the crusher is utilized as a receiving bin. A plow shaped gate controls the feed to the crusher, described in Hints and Helps in the issue of November 1, 1924.

Unusual Conveyor

The discharge from the crusher goes to a 20-in. belt conveyor, on a steel frame, which carries it to the screening plant. This belt is unusual in that only two troughing rolls are used in each set instead of three. Frank O. Reese, the plant superintendent, says that three would give less wear to the belt.

The belt runs to a chute which discharges into a Biester revolving screen 24 ft. long. It has 1-in., 1¼-in. and 3-in. perforations and ½-in. perforations in the dust jacket. The product between 1¼-in. and 3-in. is usually sold as railroad ballast, but when there is more than is

Left—The ledge of hard shale that divides the quarry. Right—The quarry face, after a shot, showing how the vertical strata are attacked and broken down

wanted of this size it may be sent to the secondary crusher along with the oversize of the screen.

The secondary crusher is a No. 2 Climax (Good Roads Co.). Its product falls to the boot of a bucket and belt elevator by which it is carried to the top of the plant, where it discharges on to the belt conveyor that brings the primary crusher discharge to the screen. This is shown in one of the accompanying pictures.

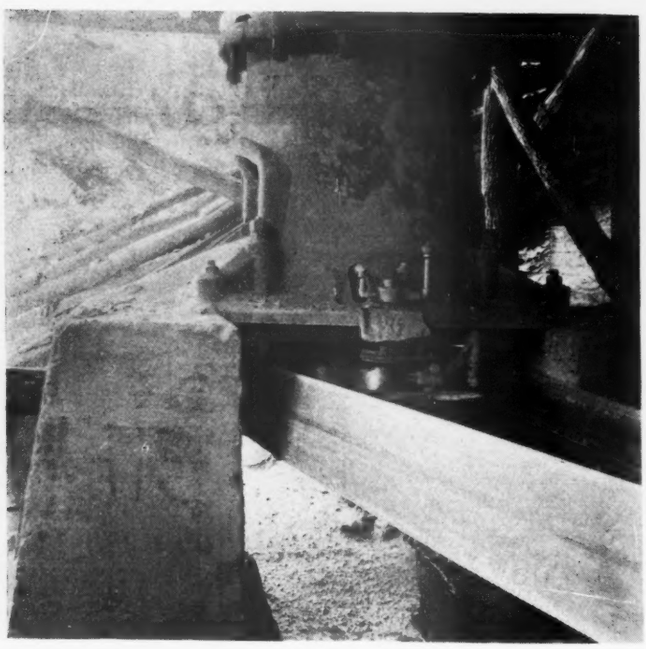
The bins hold 1000 tons and they are very well constructed. The supporting columns are of concrete connected with concrete beams. The cross beams on which the planking for the floor is laid are 10-in. steel I-beams. Segmental gates are used for loading out the different sizes.

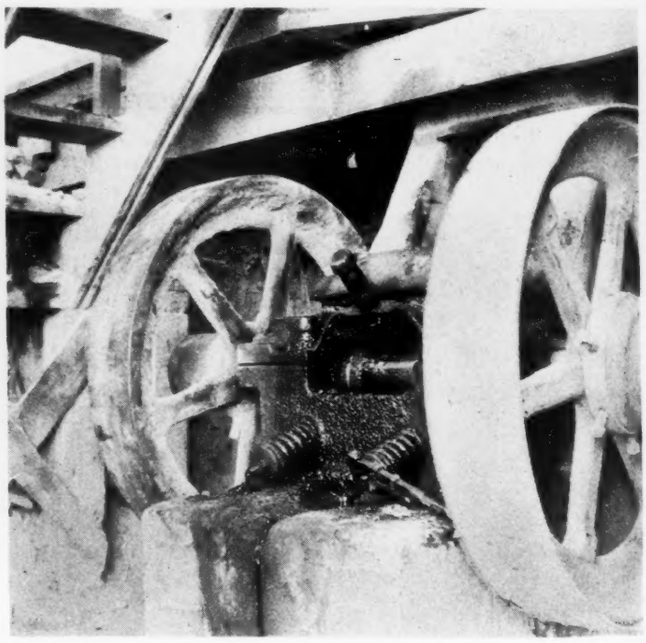
The screenings (½-in. down) find a ready sale at this plant, a part being sold for road dressing and the rest for fine aggregate for making concrete. It is said to test considerably higher than the river sand sold locally when used for making concrete as fine aggregate.

Marco belts are used throughout this plant. The conveyor belt and the belt on the gearless crusher are subjected to unusually heavy duty and this make of belt has proven itself well adapted to the conditions.

The office of the Rockville Quarry Co. is in Harrisburg. Robert McCreath is president of the company and John J. Finn is secretary and treasurer. Frank O. Reese is the superintendent in charge.

Left—The primary crusher house below the quarry has the roof covered with small stones as a protection against the fall of heavy pieces. Right—The belt conveyor has steel stringers. Only two troughing idlers are used





Left—The primary crusher is a gyratory of the gearless type. Right—The jaw crusher at the screening plant. The product of this crusher is elevated to the main belt.

Concrete Pavement Aggregates*

Investigation of the United States Bureau of Public Roads

ONE rather extensive investigation, completed during the past year at Arlington, Va., was made primarily for determining the limit of characteristics of aggregates suitable for use in concrete pavement construction. The main question involved was the determination of the minimum standard of quality. To answer this question a number of aggregates were imported from different sections of the country and a concrete-surfaced circular track was constructed with these materials. This track was tested by a special-wear machine, first fitted with rubber tires alone then equipped with tire chains.

The screening plant is on a hillside below the primary crushing plant and above the highway and railroad tracks

The conclusions which have been drawn as a result of these tests are based on three premises:†

1. That on the average 18-ft. concrete road, approximately 10% of the total traffic moving in both directions passes over a band 6 in. in width at the point of maximum concentration. Therefore, the traffic passing over the test road should be multiplied by at least 10 to obtain the equivalent volume of traffic on an actual pavement.

2. That the comparative resistance of each test section to the surface wear produced by the tire chains is an indication of the comparative resistance which would be offered by the concrete to wear or disintegration at the edges of exposed joints and cracks under service conditions.

3. That conditions which cause surface wear, such as steel tires, tire chains tracking through snow, etc., are present to such an extent as to make it necessary to give the question of wear consideration in the selection of concrete aggregates.

From the results obtained the following conclusions were drawn:

That the rate of wear of stone concrete is, in general, not affected by the coarse aggregate, provided the coarse aggregate is equal or superior to the mortar matrix in resistance to wear.

That excessive wear will result from the use of very soft stone as coarse aggregate, even though used in conjunction with a mortar of satisfactory quality. From the results of these comparative tests, it would appear that stone with a percentage of wear over 7 should not be used in concrete road construction.

That gravel concrete, in general, is at least as satisfactory from the standpoint of wear as stone concrete.

That gravels consisting essentially of siliceous materials are superior as regards both the amount and uniformity of wear to those containing a preponderance of calcareous fragments.

That gravels consisting of rounded particles are as satisfactory from the standpoint of wear as those consisting either wholly or in part of angular or crushed fragments.

That small amounts of shale occurring in the coarse aggregate will cause both excessive and uneven wear.

That the modified abrasion test for gravel in its present form is not an indication of the wear-resisting properties of coarse aggregates. It is suggested that if the severe impact action of the steel balls were decreased, much more indicative results would be secured.

The blast furnace slags should prove satisfactory for use in concrete pavements provided the proportion of light, porous slag is so controlled that the weight per cubic foot will be at least 70 lb.

That the presence of large amounts of light, porous fragments in blast furnace slag will cause excessive wear.

That somewhat better results are secured by the use of the smaller sizes of slag.

That slag or stone screenings are, in general, unsatisfactory as substitutes for natural sand as fine aggregate in concrete road construction.

That the copper and lead smelter slags used in these tests would make satisfactory aggregates for concrete road construction from the standpoint of wear.

That coarse sands, other things being equal, show greater resistance to wear than fine sands.

That the so-called "tensile-strength-ratio" test is no indication of the wear-resisting properties of concrete made with these sands.

That the Talbot Jones wear test is not, in general, an indication of the wear which takes place under traffic.

That neither the crushing nor the transverse strength of concrete is a measure of its wear-resisting properties.

That the addition of hydrated lime in the proportion used in these tests does not affect the wear-resisting properties of concrete.

That so far as resistance to wear alone is concerned, increasing the cement content beyond a cement-sand ratio of 1:2 does not materially affect the concrete. Leaner mixes on the other hand show increase in wear.

That unusual precautions should be taken in using mine chats or other similar harsh-working materials, so as to increase workability to a maximum and thus make possible a smoother surface finish.

That, other things being equal, either an excessively dry or an excessively wet mix will show less resistance to wear than concrete of medium consistency.

*From an article by A. T. Goldbeck, Chief Division of Tests, U. S. Bureau of Public Roads, Washington, D. C., in *Public Roads*.

†Wear of concrete pavement tested, by F. H. Jackson and J. T. Pauls, *Public Roads*, May, 1924, vol. 5, No. 3, p. 1.

A Visit to Indiana Sand and Gravel Plants

Deep Deposits Dug with Cableway Draglines—Much Aggregate Goes to Making Concrete Products

By Edmund Shaw
Editor, Rock Products

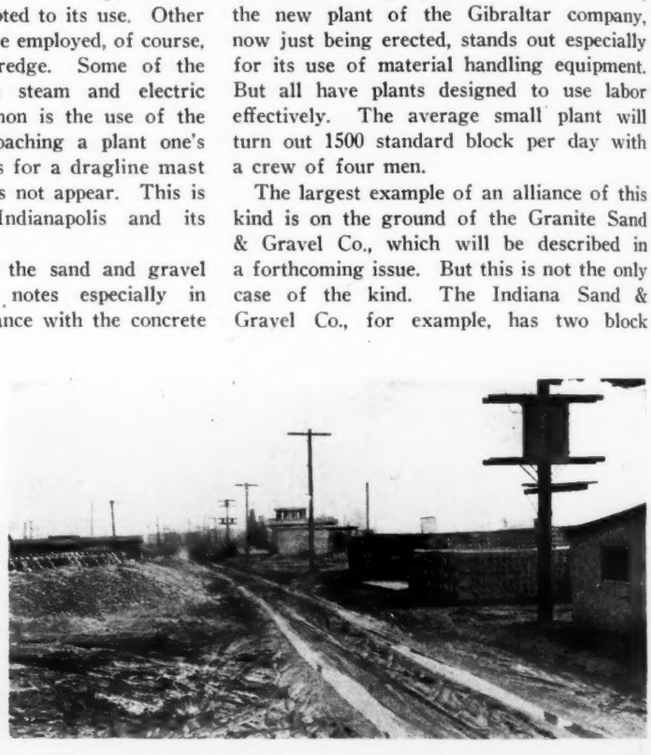
PERHAPS two-thirds of the state of Indiana is covered with glacial drift, this area covering the northern part of the state and extending irregularly down the east and west boundary lines. On the west side are the deposits of the Wabash Valley which makes this one of the large and important producing areas of the country. Much of the gravel that is dug and washed here is exported into Illinois for building the concrete roads which are beginning to cover Illinois like a network.

The depth of these deposits is remarkable. In many places good gravel is found to continue 100 and 125 ft. below the water level of the country, and much of it is dug at depths from 75 to 100 ft. The method employed at this depth is the use of the slackline cableway dragline. It is not surprising that this machine was invented and perfected in Indiana, since the deposits here are so thoroughly adapted to its use. Other means of excavating are employed, of course, notably the suction dredge. Some of the larger operations use steam and electric shovels. But so common is the use of the dragline that in approaching a plant one's eye instinctively looks for a dragline mast and misses it if it does not appear. This is especially true of Indianapolis and its vicinity.

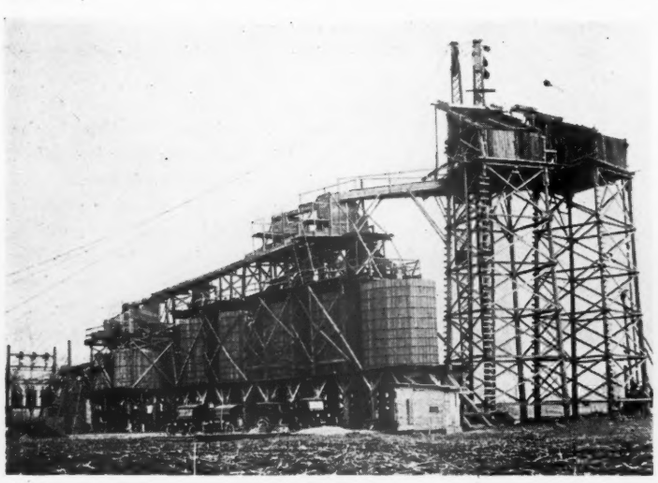
Another feature of the sand and gravel industry which one notes especially in Indianapolis is its alliance with the concrete products industry. There is an unusual amount of the finer sizes of gravel, the sizes that are known as "grits" or roofing gravel, in these deposits. The disposition of this fine gravel has sometimes been a problem to producers in times past. But in part this problem has been solved by the coming of the concrete products industry, since it makes an excellent coarse aggregate for blocks, pipe and tile. Concrete products also absorb a considerable amount of sand which many plants produce in excess of what the market demands.

There are 52 concrete products plants in Indianapolis, most of them regularly established industries with good machinery and material handling equipment. One of these, the new plant of the Gibraltar company, now just being erected, stands out especially for its use of material handling equipment. But all have plants designed to use labor effectively. The average small plant will turn out 1500 standard block per day with a crew of four men.

The largest example of an alliance of this kind is on the ground of the Granite Sand & Gravel Co., which will be described in a forthcoming issue. But this is not the only case of the kind. The Indiana Sand & Gravel Co., for example, has two block



Left—Plants of the Granite Sand and Gravel Co., Indianapolis. Right—Block plants on the ground of the Granite Sand and Gravel Co.



Left—New plant of the Eaton-Kaster Gravel Co., Indianapolis, which is just ready to begin production. Right—Material for new steel bin and new sand settler being installed by Indiana Gravel Co.

plants on its grounds, both run by the same company.

The Granite Sand & Gravel Co.'s plant is also interesting from the unusual producing system it has developed. It uses a suction dredge for digging the material, self-propelling barges of a new type for conveying the material to underwater storage and cableway draglines for recovering the material and conveying it to the plant. This system has been worked out on strictly economic lines, utilizing in each case what has proved itself the cheapest method of operation.

There are 13 fair-sized producing sand and gravel plants in Indianapolis. The newest is the plant of the Eaton-Kaster Gravel Co. at Morris street and Eagle Creek. This is a double dragline plant. There are two dragline masts set side by side, each with its own bucket and hoisting equipment. And everything else in duplicate; two receiving hoppers, two sets of screens and two sand settlers. The bins in this plant are unusual in that they are wooden silos with cypress staves. The company used silos of this kind in its old plant and was so satisfied with them that they bought them for the new plant. Everything is placed on a solid slab of concrete which is connected with a broad concrete road that is being built out to the main highway. All delivery will be by truck and the truck will have a solid footing in the muddiest weather. The plant will begin operating early in April.

Another plant, but not in Indianapolis, which was visited and found within a month of beginning production was the Interstate Sand & Gravel Co.'s plant at Covington, Ind. Covington is over in the Wabash Valley and the Neal Gravel Co., and the Covington Sand and Gravel Co. have plants there. The new Interstate plant was designed by Frank Welch of the Greenville Gravel Co.'s engineering department and will have a capacity of 50 cars a day. The material will be excavated by a Marion 37 electric shovel with an Erie steam shovel used as an auxiliary. There is about 2½ ft. of top soil which will be stripped hydraulically, the water being settled in old workings and pumped back to the monitor. The offices of the Interstate Co. are at Terre Haute.

The Neal Gravel Co., of Mattoon, Ill., which operates a number of plants in the Wabash Valley is adding to the number by a new plant at Cayuga, Ind. This will use a Sauerman dragline with a 2½ yd. bucket. It is expected to begin production early in April.

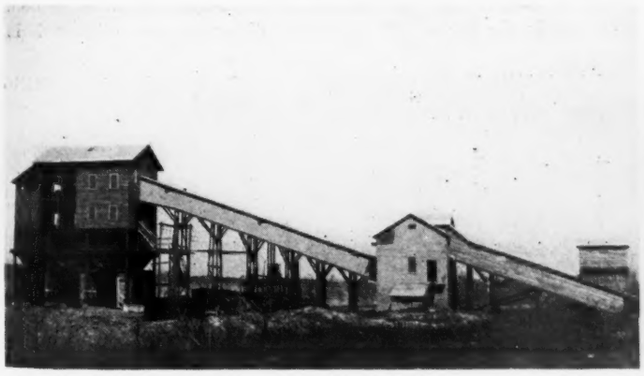
The dragline plants around Indianapolis almost without exception use gravity screens for separating the sand and gravel into sizes. This is not a thing that is commonly found throughout a district so the reasons for it are interesting. Our reason is that the great amount of headroom demanded by gravity screens is not so serious an objection to a dragline plant as it would be to some other kinds—a suction dredging plant for example. The dragline mast must have considerable height to give a steep enough inclination to the cable to return the bucket quickly, so a part of this height can be utilized as headroom for gravity screens. Another reason is that the requirements for highway material are simple and only three screens are needed to make the sizes demanded.

New Sand and Gravel Plant to Be Built at Forest Hill, Louisiana

A SAND and gravel plant will be constructed by the Gifford Sand & Gravel Co. at Forest Hill, La. The plant is being designed by W. H. K. Bennett of Chicago and will consist of a dredge and screening plant. The dredge will be equipped with a 225 hp. Anderson oil engine and a 10-in. Diamond manganese steel pump. The screening plant will have revolving screens for producing two sizes of product. The plant will have a capacity of 25 cars per 10-hour day.

Illinois Sand and Gravel Association Officers

AT the meeting of the Illinois Sand and Gravel Association held at Springfield, Ill., the following officers were elected for the year: T. E. McGrath of the McGrath Sand & Gravel Co., Lincoln, Ill., president; W. C. Roberts of the Yourtee-Roberts Sand Co., Chester, Ill., vice president; R. E. Weaver of the Lincoln Sand & Gravel Co., Lincoln, Ill., secretary and treasurer.



Left—New plant of the Interstate Sand and Gravel Co. just being completed at Covington, Ind. Right—Steel dredge of the Atlas Sand and Gravel Co., Indianapolis

Left—Neal Gravel Co.'s plant at Covington, Ind. Right—Plant of the Covington Sand and Gravel Co. at Covington

Sands for Limes, Gypsum and Cement Plasters*

A Study of the Characteristics Necessary for Plastering Sands and a Comparison of These with the Standard Specifications

By H. V. Johnson
Bureau of Standards, Department of Commerce, Washington, D. C.

WORK was begun at the Bureau of Standards on the subject of "Plastering Sands" by securing fifty-three representative samples of what were regarded as good plastering sands in their respective localities.

These sands were given a sieve analysis. From these results the surface modulus for each sand was computed according to the formula given by Talbot (3)†, and the fineness modulus according to the method outlined by Abrams (4).

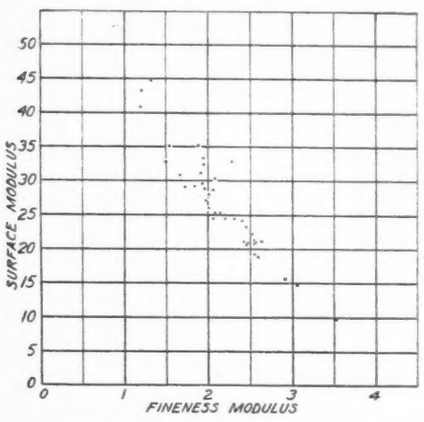


Fig. 1—Surface modulus plotted with fineness modulus

From each of these sands were made lime plaster 1:3 by weight; gypsum plaster, 1:2 by weight; and from 20 of them, portland cement plasters, 1:3 by weight. A record was kept of the percentage of mixing water required to bring each mix to a consistency such that it would slump ¼ in. after being filled into the standard sized rubber ring (5) and the ring removed. The plasticity of the wet mixes was tested by means of the Emley plasticimeter (6). A test was also made of the tensile strength of briquettes of each mortar aged for seven days in the air.

Using the values of the surface moduli as ordinates, and those for fineness moduli as abscissas, the 53 points were plotted. See Fig. 1. The points lie fairly close to a straight line, which shows that in these naturally occurring sands there is some relation between surface modulus and fineness modulus, as was pointed out by Young (2). The degree of divergence of some of these points from a straight line, however, is sufficient to show that either one or both of the above methods of measuring fineness of a sand must be imperfect.

The percentage of mixing water, the plasticity, and the tensile strength of the mortars from 12 of the sands are given in Table I. No relationship was found to exist between these properties and the fineness of the sand, by plotting of results.

It was found that 26 sands passed the tentative specifications for gypsum plastering sands (7), while 27 did not. Table II gives a comparison of results obtained with these two classes of sands. For lime and gypsum, about as good results were obtained in plasticity and in tensile strength with the sands not passing, as with those passing the tentative specifications. The most noteworthy difference was in the tensile strength of the cement mortars; the sands not passing resulted in less tensile strength, which probably is due to the greater percentage of mixing water required by the finer sands. A 1:3 cement mortar is sufficiently lean so that the character of the sand is a contributing factor governing the percentage of mixing water required for a given workability. In every case where the mixing water was 20%, or over, the resulting tensile strength was less than 100 lbs. per square inch. With less than 20% of water, the tensile strength of the cement mortars was over 100 lbs. per square inch.

In order to show more clearly what effect the fineness of the sand has upon the required amount of mixing water, the plasticity, and the tensile strength of mortars, different grades of Potomac River sand were used separately with lime and with gypsum. No noticeable difference was detected in

TABLE I. SURFACE MODULUS AND FINENESS MODULUS OF TWELVE PLASTERING SANDS, WITH PERCENTAGE OF MIXING WATER, PLASTICITY AND TENSILE STRENGTH OF LIME, GYPSUM, AND PORTLAND CEMENT MORTARS

Properties of Mortars and Sands	San Francisco, Calif. (Bank Sand)	Indianapolis, Ind.	Wilmington, Del.	West Rutland, Vt.	New Orleans, La. (Lake Shore)	Minneapolis, Minn.	*Louisville, Ky.	*Grand Rapids, Mich.	Elliston, Mont.	*St. Louis, Mo. (Mississippi River)	*Cleveland, Ohio.	*Laramie, Wyo.
Lime—												
Per cent water	30.8	29.3	29.7	31.2	29.7	33.0	28.8	28.8	31.1	28.9	28.3	35.0
Plasticity	118	123	120	118	122	125	117	114	119	119	116	125
Tensile str., 7 days	24	14	17	17	14	12	14	10	12	15	14	8
Gypsum—												
Per cent water	23.0	23.8	27.7	24.8	25.2	25.7	23.2	23.3	26.6	22.1	21.7	19.9
Plasticity	90	80	148	70	129	94	86	131	146	132	134	110
Tensile str., 7 days	251	249	236	287	281	208	268	285	227	278	313	356
Cement—												
Per cent water	.....	20.9	22.4	.....	.....	17.7	20.0	17.0	19.1	16.2	14.5	.....
Plasticity	.....	86	59	.....	.....	69	65	90	88	92	89	.....
Tensile str., 7 days	.....	83	74	.....	.....	122	90	151	143	148	158	.....
Surface modulus	40.8	33.7	30.9	45.9	27.9	29.6	26.0	24.5	32.9	23.2	17.9	9.9
Fineness modulus	1.20	1.66	1.67	1.76	1.89	1.94	2.01	2.06	2.29	2.37	2.76	3.53

*Passing tentative specifications for gypsum plastering sands.
*Passing tentative specifications for gypsum plastering sands (7).

TABLE II. COMPARISON OF SANDS PASSING TENTATIVE SPECIFICATIONS WITH THOSE NOT PASSING TENTATIVE SPECIFICATIONS, IN REGARD TO PLASTICITY, AND TENSILE STRENGTH OF LIME, GYPSUM AND CEMENT PLASTERS

	Lime		Gypsum		Cement	
Plasticity—	26 sands passing	27 sands not passing	26 sands passing	27 sands not passing	7 sands passing	13 sands not passing
Maximum	148	152	140	148	91	110
Minimum	114	115	83	57	65	40
Average	123	124	119	97	84	68
Tensile Strength (7 days)—						
Maximum	17	24	356	288	162	143
Minimum	8	10	207	208	78	40
Average	13.4	14.5	273	247	131	89
Mixing Water—						
Maximum	36.8	35.7	26.2	29.1	21.4	23.9
Minimum	27.5	28.7	19.6	21.2	14.3	17.5
Average	31.2	32.1	22.4	25.0	17.1	20.3

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†References found on page 59.

TABLE III. TENSILE STRENGTH AND PLASTICITY OF LIME AND GYPSUM PLASTERS MADE WITH GRADED POTOMAC RIVER SAND. THE LIME PLASTERS WERE 1:3, AND THE GYPSUM PLASTERS 1:2 BY WEIGHT; THE CONSISTENCY WAS MEASURED BY ONE-QUARTER INCH SLUMP WITH THE RUBBER RING

Lime—	8-16	16-30	30-50	50-70	70-100	100-200	Through 200
Per cent water	29.5	29.0	32.5	33.3	35.2	39.1	52.0
Plasticity	119	114	116	123	122	113	87
Tensile strength, 7 days	12	13	19	15	19	21	18
Gypsum—							
Per cent water	20.5	23.9	28.2	28.1	32.8	34.1	40.2
Plasticity	115	93	106	136	91	85	84
Tensile strength, 7 days	226	235	201	225	197	197	133

the resulting plasticity of the mortars, but the percentage of mixing water increased with the fineness of the sand, whether lime or gypsum was used. The tensile strength of the lime mortars increased with the fineness of the sand, while the reverse was the case with gypsum mortars, in which

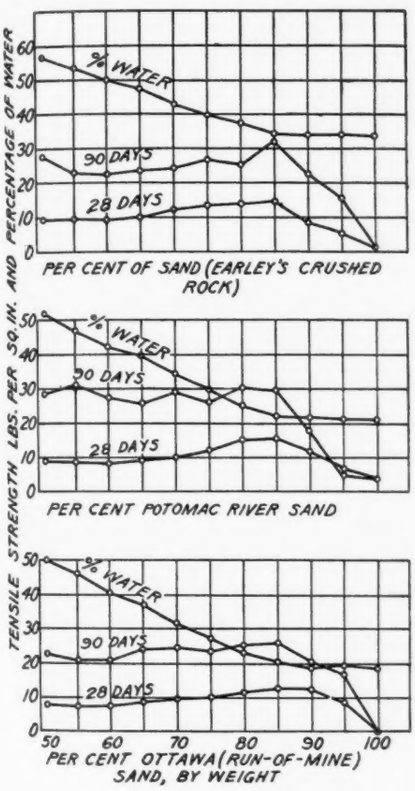


Fig. 2

case the effect of that portion of the sand passing a 200-mesh sieve was the most deleterious. These results appear in Table III.

The work up to this point shows rather clearly that the tentative specifications for gypsum plastering sands, while insuring a good sand for use with gypsum, debar the use of many sands which are thoroughly satisfactory. This preliminary work showed that it was not feasible to prepare a specification for plastering sands based upon sieve analyses; moreover, a specification condemning sand locally available could not be enforced. The undertaking was therefore changed to an attempt to solve the question of how much sand can be used in lime and in gypsum plasters.

Lime Mortars and Plasters

In this new line of work is shown the effect of a variation in the amount of sand upon the percentage of mixing water and the tensile strength of lime mortars. Some interesting results were obtained with mason's hydrate *A* and three different sands; the results are shown by the curves in Fig. 2, while the sieve analyses of the sands are given in Table IV. The curves in Fig. 2 show that a maximum strength was obtained in 28 days when 15% of lime by weight was used; and with this same mixture occurs a decided break in the curve for mixing water. The increase in strength from 28 to 90 days was due to further carbonation of the lime.

Similar tests were made with two mason's hydrates and two finishing hydrates, used with Potomac River sand, the latter varying from 0 to 100%, by increments of 5%. From the curves in Fig. 3 it is seen that there is little difference in the tensile strength in 90 days for the four hydrates which con-

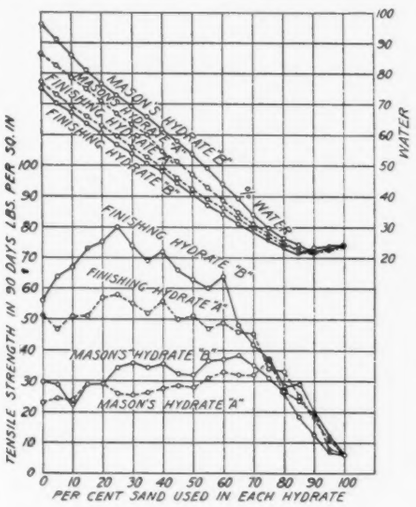


Fig. 3

tain 75% of sand or over. While the mortars from the two mason's hydrates had about their maximum strength at this point, the strength of the mortars from finishing hydrates reached a miximum with only 25% of sand. The amount of mixing water was found to be a minimum when the mortars contained 85 and 90% of sand by weight.

Since the durability of a plaster in place can not be determined entirely by the strength and amount of water employed, it was considered highly desirable to test as many properties as possible of the different sanded mortars. Potomac River sand was again used, but it had not been passed through a 20-mesh sieve as before; and the consistency was measured by a slump of ½ in. with a 2x4-in. cylinder. The data covering the composition of the mortars and properties tested are to be found in Figs. 4 to 7.

The percentage of mixing water, based on the weight of the dry mix, gradually decreased with an increase in sand, and was found to be a minimum in those mixes containing from 85 to 90% of sand by weight. This is shown by the curve for mixing water in Fig. 4. In determining the amount of mixing water required for normal consistency, as measured by the 2x4-in. brass cylinder, it is sometimes impossible to get a real sticky neat material to slip out of the cylinder without sticking. In such cases, the mixing water required by several sanded mortars, such as those containing 70, 50, and 30% sand by weight, can be determined

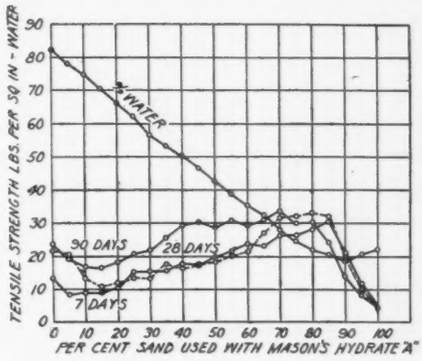


Fig. 4

without this difficulty of sticking. A line drawn approximately through these points and projected until it intersects the ordinate representing the neat material will indicate the required amount of mixing water for the same.

It will be noted that the strength of some of the sandier mixes for 90 days was less than for seven days and for 28 days. This result probably is caused by a difference in humidity on the days when the briquettes were broken, for if other conditions are the same, lime mortars should be as strong at 90 days as at any shorter period of time. When 15% of lime by weight is used, a longer period of time can not be expected

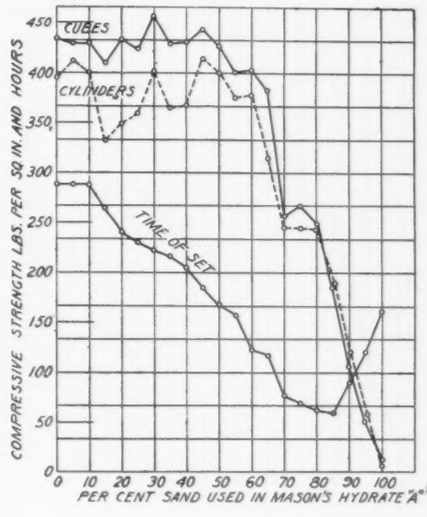


Fig. 5

TABLE IV. SIEVE ANALYSES OF OTTAWA SAND, EARLEY'S CRUSHED ROCK, POTOMAC RIVER SAND, AND TRIPOLI FLOUR

Per cent retained on sieve	Ottawa (run-of-mine)	Earley's crushed rock	Potomac river sand	Tripoli flour
30	4.	....	23.	....
50	62.	....	46.	....
70	19.4	1	16.	1.
100	10.	15	8	3.
140	....*	14	....*	....*
200	4.	25	5	8.
Through 200	0.6	45	2	88.

*Sieve 140 not used.

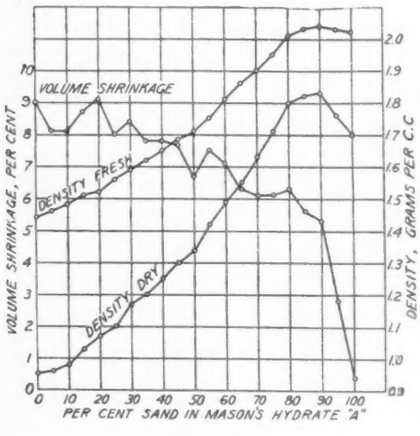


Fig. 6

to increase the strength above that obtained at 28 days, for carbonation of the lime is fairly complete by that time in a porous sandy mortar. Where the mortar is richer, a longer period is required for complete carbonation of the lime. (The above remarks on time for carbonation do not apply to masonry construction, for in such cases the interior portion of the mortar carbonates extremely slow.) The minimum mixing water was 19.5% for the mortar containing 10% of lime by weight.

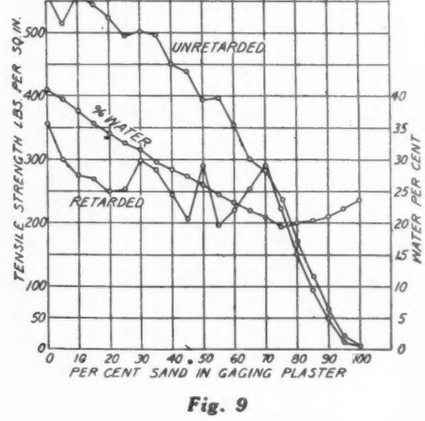


Fig. 9

The compressive strength of these mortars aged for one year is shown by the curves in Fig. 5, which also contains a curve for the time of set. The time of set was measured by the Vicat needle, the end point being taken when the mortar would sustain the needle without showing any depression when the needle was removed. Setting included drying out, and a certain amount of surface carbonating in the richer mixes. The shortest time of set occurred

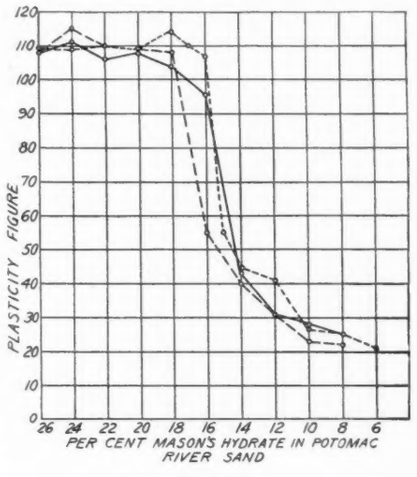


Fig. 7

in the lime mortar containing 85% of sand by weight. Mortars of each mix were tested for compressive strength, tests being made on both 2x4-in. cylinders and 2-in. cubes, but the results indicate that it makes little difference whether tests are made on cylinders or on cubes.

The volume shrinkage of each mix was determined by filling a brass mold with the mortar and measuring the volume with micrometer calipers after drying for 10 days. The average of five measurements was taken for the depth, and of three for the lateral dimensions. The size of the molds was about 3 in. x 3 in. x 0.5 in. The same specimens were used in the determination of density, both fresh and after drying. The curves showing volume shrinkage (based upon per cent of original volume) and density are given in Fig. 6.

The volume shrinkage of neat lime (mason's hydrate *A*) was 9%. As we proceed from neat paste to sand, the volume shrinkage gradually decreases up to about 90% of sand, after which the decrease is more rapid. This was true of both the mason's hydrate and the plastic hydrate. The lime is dominant over the sand in regard to shrinkage down to the point where it fills the voids in the sand. The density increased regularly with an increase in sand up to 90%, and with

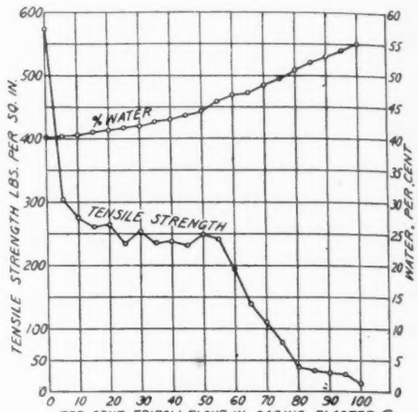


Fig. 8

more sand the density decreased. (These values for density are for a definite consistency, and do not represent the possible maximum density for any of the mixes.) When the lime putty is reduced in amount so that it cannot fill the voids in the sand, it becomes necessary to add more water to lubricate the sand in order to get it to slump. The effect of this extra water is to reduce the density; it has more effect on the density of the dry mortar, for it evaporates and leaves the mortar porous.

Plasticity tests were also made on sanded lime mortars containig from 8 to 26% of lime by weight. A number of different hydrates were used, and the results obtained with three are shown in the curves of Fig. 7. There appears to be a definite drop in the plasticity figure when the mortar contained from 82 to 84% of sand. Regardless of the plasticity of the neat lime paste, a plasticity figure of about 30 was obtained for the mortars which contained 12% of lime by weight.

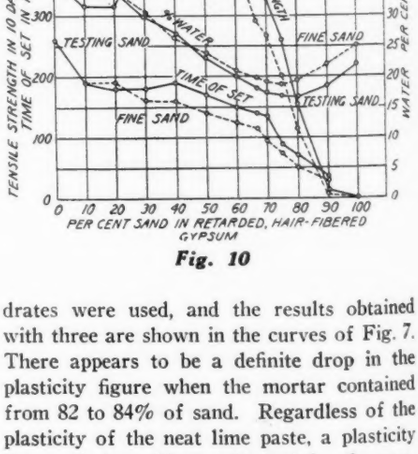


Fig. 10

All of the above mentioned properties were also tested in mortars made from plastic hydrate and Potomac River sand, both

TABLE V. SIEVE ANALYSIS OF SANDS USED WITH RETARDED HAIR-FIBERED GYPSUM

Retained on sieve	Testing sand, per cent	Fine sand, per cent	Jersey gravel, per cent	Bar sand, per cent
8	0.0	0.0	15.3*	3.0*
16	7.1	0.4	12.4	5.2
30	20.0	1.7	16.6	13.3
50	55.5	26.5	41.6	46.6
70	13.0	50.7	21.8	25.2
100	3.0	15.3	4.7	6.7
200	1.1	5.2	2.1	2.3
Through 200	0.3	0.2	0.8	0.7
Voids, per cent	33.3	36.2	35.3	37.5

*Percentage of sample as received; the other percentages are based on total sand passing No. 8 sieve.

soaked over night and not soaked. (The plastic hydrate was made by grinding mason's hydrate *A* with 2% of quicklime in a ball mill.) The distinctive feature of this hydrate was its excessive shrinkage. The mixing water used for the neat paste without soaking was 68.3%, with a volume shrinkage of 15.9%; soaking over night and retempering requiring 85% mixing water for the same consistency, with a resulting volume shrinkage of 27.7%. Volume shrinkage is quite sensitive to a slight change in the

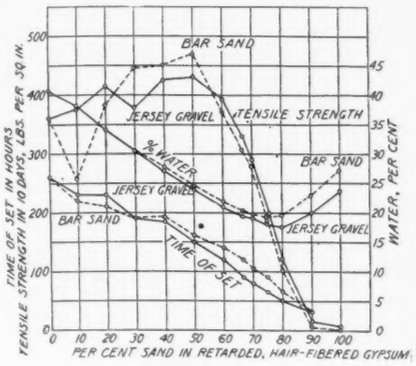


Fig. 11

amount of mixing water, even more so than is the slump test for consistency.

Some similar results were obtained by E. E. Berger at this bureau, who made mortars from three quicklimes and two hydrates. In general, where the mortars contained 85% of sand by weight, the required mixing water was a minimum, the tensile strength in 28 days was a maximum, and the volume shrinkage decreased more rapidly with more sand.

From all the data herein presented, the following conclusions are drawn concerning lime mortars: The most desirable combination of properties of lime mortars can be secured in fairly lean mixes. The strength of a lime mortar in 28 days is usually a maximum where the sand is about 85% by weight. This mix also has greatest density, both fresh and after drying, and it also has the shortest time of set. The amount of mixing water is a minimum. The plasticity of mortars of this composition was found to be about the same regardless of the plasticity of the neat lime putty. Volume shrinkage of mortars of this composition is not excessive, for the lime paste is reduced to such an extent that the sand has a salutary effect in checking shrinkage.

Gypsum Mortars and Plasters

Some further tests on gypsum plasters were made. Gaging plaster was used with different percentages of tripoli flour and of Potomac River sand. The sieve analyses of these two sands are given in Table IV. It was found that 5% of tripoli flour caused the tensile strength of the gypsum to drop from 573 to 303 lb. per square inch. With more tripoli flour the rate of drop was not rapid until after 55% had been added. On account of the fineness of the tripoli flour, the percentages of mixing water increased as this sand was increased, neat gypsum requiring about 40% water while this sand required 55% water. These results are given in Fig. 8. They are a strong argument against the use of excessively fine sand with gypsum.

There are two series of plasters made with Potomac River sand. One set was unretarded, and the other was retarded with 0.15% commercial retarder, based on dry weight of gypsum. The percentages of mixing water were the same in both series, and minimum water was required for the 1:3 mix by weight. From this it is evident that the gypsum fills less voids in the sand than the same weight of lime; the gypsum is apt to contain more or less inert material which is really sand. (The consistency for these two series was measured with the rubber ring.)

The curves for tensile strength in Fig. 9 show no appreciable effect of the retarder until less than 70% of sand was used, when

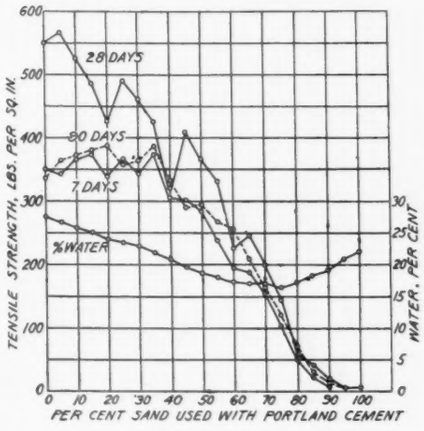


Fig. 12

the retarded mixes were weaker than those unretarded.

To throw more light on the subject of gypsum plastering sands, two sands were secured from Grand Rapids, Michigan, and two from Philadelphia, Penn. In each case a good sand and a poor sand were supposed to be represented, the finer sand being considered a poor sand for gypsum.

After making sieve analyses, and determining the percentage of voids in each, these sands were tested with retarded, hair-fibered gypsum in varying proportions by weight, for percentage of mixing water, tensile strength, and time of set. (The consistency was measured by the use of a 2 in. x 4 in. brass cylinder.) Sieve analyses are given in Table V, and other data in Figures 10 and 11. In all of these mixes containing over 50% gypsum, there was a part of the gypsum which had dried out on the surface before it had set, the amount increasing with the decrease in sand. This explains why the tensile strength fell off in all of the richer mixes. A study of the time of set shows why this occurred. The sands were found to counteract the effect of the retarder in proportion to the amount of sand present. With less than 50% sand, this action was so slight that the set was due to drying of the gypsum before it had crystallized.

The "fine sand" from Grand Rapids, and the "bar sand" from Philadelphia were considered the poor sands. Compared with the sands which accompanied them, they contained a greater percentage of voids, and minimum mixing water was required for the mixes containing 75% sand instead of 80% as for the other two sands; and this minimum water requirement was about 2% greater (slightly less than the difference in the percentage of voids). In regard to the effect on time of set, the honors were equally divided, for the fine sand from Grand Rapids had greater accelerating effect on the time of set than had the coarser sand, while the reverse was true in the case of the two sands from Philadelphia. As far as these tests are concerned, there appears to be no reason why any one of the above four sands could not be used satisfactorily with gypsum.

The claim is made that coarse sands must contain a certain amount of gypsum in order to be sufficiently plastic for a mason to spread them after the mixing water has been added, but that fine sands which are deficient in gypsum can be made sufficiently plastic by adding an excess of water, so that the man who is mixing will be deceived by appearances. Thus it happens that the fine sands, mixed to give the desired spreading qualities, sometimes produce a crumbly brown coat, merely because the gypsum was oversanded, and the sand is pointed out as one to be avoided for plastering purposes. The specifications for sanded gypsum plasters (8) are supposed to take care of that

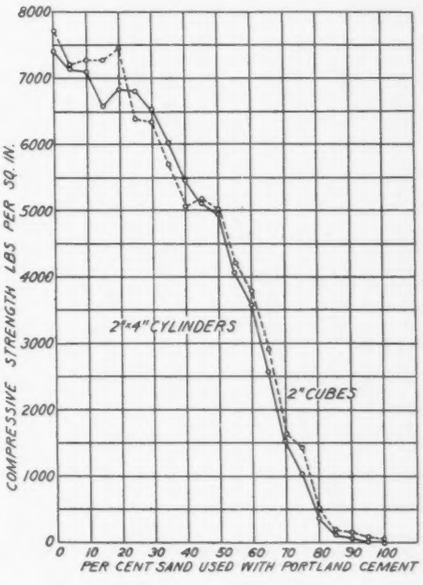


Fig. 13

situation, for they give the minimum amount of gypsum which should be used for scratch coat and brown coat plasters.

It is impossible to do justice to the subject of plastering without some consideration of the importance of workmanship. It is well

known that gypsum plasters and portland cement plasters should not dry out before they have thoroughly set. Neither should the wall rob them of their mixing water so rapidly that the mason can not spread them. It seems to be the object of the contractor to get rid of the expensive services of a mason as soon as possible. Some contractors say they prefer to secure a better working plaster by adding more gypsum than to pay for the extra time which it would take a mason to spread a leaner plaster.

If gypsum plaster is not oversanded, and is retarded to meet all the conditions on the job, such as the requirements of the sand, the mixing water, the wall, and the presence or absence of set plaster in the mortar box, no trouble should be experienced from the sand if it does not contain an excessive amount of fine material passing a No. 200 sieve; such fine material greatly weakens the strength of the gypsum when present in appreciable amounts.

A thorough consideration of the subject of gypsum plasters requires that some attention should be given to the amount of inert, sandy material already in the calcined gypsum in considering how much sand the latter will take.

Portland Cement Mortars and Plasters

A series of tests was made on mortars composed of varying percentages of portland cement and Potomac River sand. These tests included the properties considered in connection with lime mortars. In this there is some departure from standard methods of testing cement mortars; but these cement-sand mortars were part of a series of cement-lime-sand mortars in which the three ingredients entered into the composition in widely different proportions, and in order to obtain comparable results, it was necessary to follow the same procedure throughout.

The results of tests on tensile strength and percentage of mixing water are plotted in Fig. 12. The minimum mixing water was found to be 16.3% for the mortar consisting of 75% sand by weight. The curves show the increase in tensile strength from 7 days to 28 days, and a retrogression from 28 days to 90 days.

In Fig. 13 are plotted results of compressive strength tests, made at the end of one year, on cylinders. Greatest strength was obtained with mixes approaching neat cement. In cement mortars it was found that the use of finer sands requiring over 20% water for a 1:3 mortar resulted in less strength than where sands were used which required less mixing water. It should be noted that the test specimens were in molds on glass plates during the setting of the cement, but that in practice water is taken out of the mortar before it sets, in cases where the mortar is applied to brick or other absorbent bases. Portland cement mortars should not be deprived of water to the extent that there is not enough left for the proper hydration of the cement.

In Fig. 14 are shown graphically the results of tests on density of the mortars (both fresh and after drying), on volume shrinkage, and on plasticity. For the consistency which was used, the maximum density was found for the mortar consisting of equal weights of cement and sand. Since the sand contained 35.7% voids, the theoretical amount of cement to fill these voids would be 35.7% of the combined weight of cement and sand, or 55.5 per cent based on the weight of the sand only. (This calculation is made on the assumption that equal volumes of cement

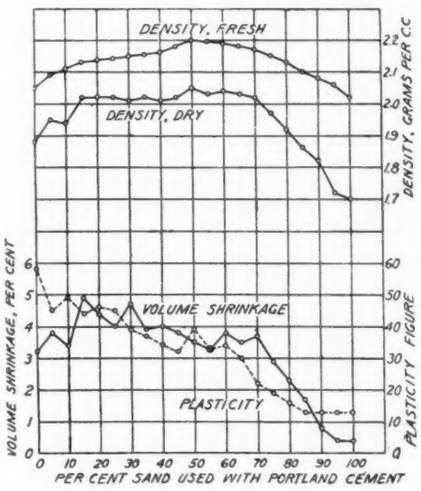


Fig. 14

and sand are equal in weight.) This amount of cement did not give a mortar of greatest density, because it did not fill all the voids. This is due to the fact that some fine cement lodges between sand grains which were in contact before mixing. The volume shrinkage does not decrease noticeably until more than 70% sand has been used. There is a gradual fall in the plasticity with increase in sand, until 85% sand is reached, when it is about the same as straight sand.

No increase in time of set is noted until the mix containing 70% sand is reached, then further additions of sand increase the time of set. It is probable that the cement actually set in all of the mixes in about eight hours, but in the leaner mixes extra drying was necessary before the mortar would support a Vicat needle.

It would be possible to make use of the water requirements for sanded mixes of lime, gypsum, and portland cement as a means of eliminating excessively fine sands, without any reference to the sieve analysis of the sands. This would apply especially to the mixes requiring a minimum amount of mixing water. A different water requirement would be necessary for lime mortars than for gypsum mortars or for portland cement mortars. The fact that different limes require different amounts of water for neat pastes of the same consistency might suggest itself as an obstacle to this method of eliminating fine sands. However, it should be remembered that when the lime mortar is so lean that the minimum percentage of mixing water is required, the effect of this difference in the limes vanishes, and the sand is then sufficient in amount so that its fineness is the determining factor for the water requirement. This is supported by the curves in Fig. 4 for mixing water for different hydrates. In lieu of sieve analyses, it would be possible to eliminate excessively fine sands from plastering by setting a limit to the percentage of mixing water which should not be exceeded. If lean mixes are considered, which require minimum water for a given consistency, it is suggested that the water requirement might be limited to 30, 25, and 20% for lime, gypsum, and portland cement mortars, respectively.

Some experiments were made by Wiley (9) on 32 Illinois sands. With each of these he made 1:3 portland cement mortars by weight, and used 9% mixing water, regardless of the resulting consistency. It is very probable that the results would have been of more value if the same consistency had been used throughout the tests, instead of an arbitrary percentage of mixing water. The principal basis for the evaluation of these sands for mortar-making was the tensile strength of cement mortars aged in water for 90 days. At the end of the paper he has given some specifications for plastering sands, which include those intended for use in lime mortars and plasters. While these specifications probably insure the use of good sands with lime, they are not based upon the tests of any properties of lime mortars, therefore, there is nothing to show that other sands could not be used with lime with equal success.

Summary of Conclusions

1. When mortars with varying percentages of sand were brought to the same consistency by adding water, a minimum amount of mixing water was required where the cementing material was reduced to a definate amount; this amount was found to be about 15% for lime, and about 25% for gypsum and for portland cement.

2. By setting a limit to this minimum water requirement, excessively fine sands could be debarred from use in mortars and plasters, without reference to a sieve analysis of the sand.

3. The most desirable combination of the properties of lime mortars is to be obtained in fairly lean mixes, regardless of the kind of lime or sand used. Therefore, a weight specification for lime-sand mortar appears to be perfectly feasible and justifiable.

4. The present "Tentative Specifications for Gypsum Plastering Sands" are too severe, in that they would exclude many sands which are thoroughly satisfactory when used with gypsum.

5. Sands differ in the effect which they have upon the time of set of retarded gypsum plaster. The latter should be retarded to meet the conditions on the job, such as the requirements of the sand, the mixing

water, the character of the wall, or contamination by set gypsum plaster.

6. The amount of gritty, inert material in calcined gypsum should be taken into consideration when determining how much sand to add.

7. The strength of portland cement mortars was found to increase when such a choice of sands was made that a decrease occurred in the required amount of mixing water.

The numbers given in the text refer to the following:

1. Edwards, L. N., Proportioning of Materials of Mortars and Concretes by Surface Area of Aggregates. Proc. A. S. T. M., Vol. 18, Part 2, p. 235; 1918. Engineering News Record, Vol. 81, p. 317; August 15, 1918.
2. Young, R. B., Some Theoretical Studies on Proportioning Concrete by the Method of Surface Are of Aggregates. Proc. A. S. T. M., Vol. 19, Part 2, p. 4447; 1919.
3. Talbot, A. N., (Discussion of Young's Paper on Proportioning of Concrete). Proc. A. S. T M., Vol. 19, Part 2, p. 481; 1919.
4. Abrams, D. A., Design of Concrete Mixtures, (Fineness Modulus of Aggregates), Minutes of the Annual Meeting of the Portland Cement Association, p. 24; December, 1918. Bulletin 1, Structural Materials Research Laboratory, Lewis Institute, Chicago, p. 4; April, 1919. Engineering News Record, Vol. 82, p. 759; April 17, 1919. Concrete, Vol. 14, p. 192; May, 1919.
5. C9-21, Standard Specifications and Tests for Portland Cement. A. S. T. M. Standards, p. 642, section 38; 1924.
6. C6-24, Standard Specifications for Hydrated Lime for Structural Purposes, (Methods of Test.—Plasticity). A. S. T. M. Standards, p. 718, section 13; 1924.
7. C35-21T, Tentative Specifications for Gypsum Plastering Sands. Proc. A. S. T. M., Twenty-fourth Annual Meeting, Vol. 21, p. 559; 1921.
8. C28-21, Standard Specifications for Gypsum Plasters. A. S. T. M. Standards, p. 728; 1924.
9. Wiley, C. C., The Mortar-Making Qualities of Illinois Sands. University of Illinois, Engineering Experiment Station, Bull. 70; December 1, 1913.

Twin Cities to Sell Aggregates by Dry Weight

BEGINNING April 1, 1925, sand, gravel and stone sold in the Twin Cities, that is Minneapolis and St. Paul, will be sold on the ton basis, rather than the yard basis. This action was agreed upon by the various producers located in this trading center. They felt that prices figured on a bulk basis were not fair, and there were too many chances for error to both the consumer and the producer.

The question was also brought up on account of the fact that several of the plants which did not wash their sand and gravel claimed that users buying from washing plants were paying for moisture. Those plants which wash their material then started to make allowance for moisture content, and did it in this manner: A cubic foot sample of material, as it is taken from the plant, was carefully weighed, it was then placed on a charcoal stove and dried completely, then reweighed. The difference in the two weights represented the moisture contents of the material, as it was coming from the plant, and in selling material, allowance was made for this particular moisture content. These moisture tests were taken every hour, and the producer buying from a washing plant is now paying for his material on the basis of dry sand only, and in addition thereto he is sure of getting a clean product.

J. K. Davison and Bro. Buys Plant at Parnassus, Penn.

THE entire equipment of the Valley Sand and Supply Co., at Paranassus, Penn., valued at $700,000 was purchased, according to the *Pottsville (Penn.) Journal*, by the J. K. Davison & Bro., sand and gravel producers of Pittsburgh recently.

The Valley Sand and Supply Co., dredged its material from the Allegheny river at Parnassus and New Kensington and had an annual output of over 350,000 tons of washed, screened and graded product. The equipment of the company consisted of three dredges, two gasoline towboats, one derrick boat, two sections of dock, 28 wooden flats, two car loading plants, a large retail yard in New Kensington including a modern cement block plant.

The addition of this plant to be taken over April 1 makes the Davison company the largest sand and gravel producer in the state and it will then operate three towboats, six sand and gravel dredges including the *Allegheny* described in the December 13, 1924, Rock Products, 30 all steel barges, 130 sand flats and seven river to rail transfer plants. The company plans to extend its dredging operations 20 miles further up the stream and thus have practically virgin territory from which to secure its product.

The officers of the J. K. Davison and Bro. are George Mc. Davison, president; Butler R. Davison, vice-president; Harry F. Davison, secretary and treasurer, and William L. Smith, sales manager.

Road Material Controversy in Ohio Is Hot

A CONTROVERSY between Governor Vic Donahey and Ohio Highway Commissioner L. A. Boulay developed recently, which resulted in the demand on the part of the governor for the resignation of Commissioner Boulay. This was refused and the highway commissioner will continue to head the department until Aug. 11 when his year's term expires. The mixup came about over a paving contract in Butler County in which the highway commissioner specified Kentucky rock asphalt and the governor desired concrete to be used. Neither would yield in the matter and it resulted in the demand for Mr. Boulay's resignation and his refusal to resign. Since the office is constitutional there is no way for the governor to have the office declared vacant unless Mr. Boulay will step down.—*Engineering News-Record.*

Great Northern Ballast Plants

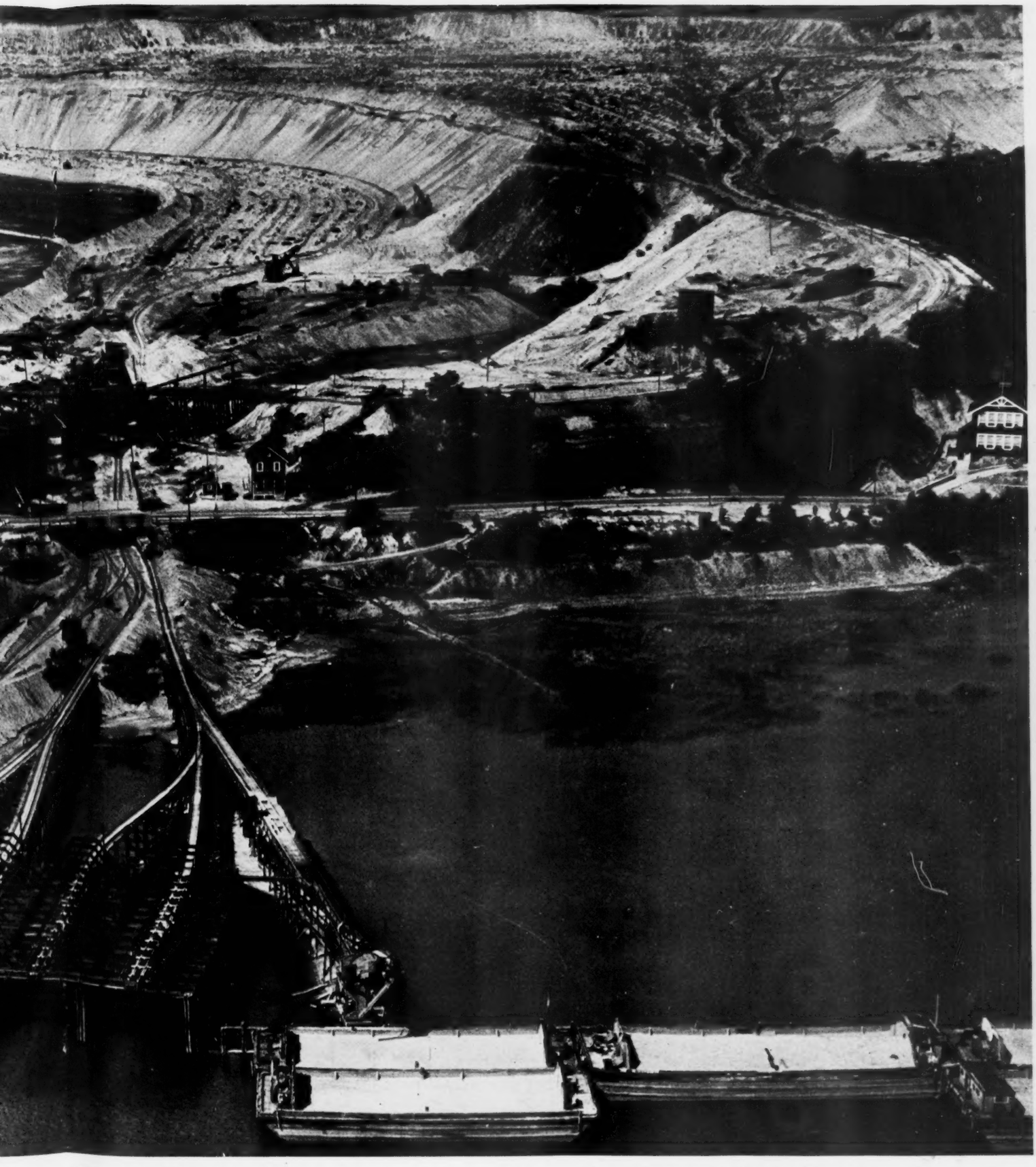
THE J. L. Shiely Co., prominent stone and sand and gravel producers of St. Paul, Minn., have recently taken a contract with the Great Northern Railway for the building and management of a number of plants on the main line of the Great Northern from St. Paul west to the Coast. Two of these plants are now under construction, and at latest reports, are well under way. Material and equipment is being delivered on the job, and they will probably be in operation in the next 60 days. One is located at Chinook, Mont., 1,000 miles west of St. Paul on the Great Northern and the other is Warland, Mont., 1,375 miles west of St. Paul. These plants were designed and built under the supervision of the J. L. Shiely Co. The Great Northern Railway purchased and owns the property and equipment, and the Shiely company will operate them for the railway company.

The operators will receive a cost-plus price per ton, for all ballast produced for the railway. They are not limited, however, to producing material for the railroad alone, as the contract gives them permission to develop as large a local business as they wish. For all material taken out of the plant and used for commercial purposes the Shiely company will pay the railway a certain price per ton.

The plants now being constructed are almost exact duplicates of the new sand and gravel plant of the Shiely company of St. Paul. The crushing and conveying equipment are designed for 2,000 tons capacity; present plans however call for screening equipment of just 1,000 tons; this means that instead of the two batteries of conical screens used at St. Paul, present plans call for the installation of one set of this kind. Provisions have been made for the installations of the other set as soon as business warrants its use.

Equipment already purchased for the two plants, include four 8-ton Whitcomb gas locomotives; twelve 5-yard Koppel side dump cars; two Industrial cranes with 1½-yd. clamshell bucket; and two Bucyrus 1-yd. gas shovels.

The Phoenix plant of the Goodwin-Gallagher Sand and Gravel Co., Cow Bay, on the north shore of Long Island, New York. To the extreme le



he extreme left is the Gallagher plant which we will illustrate in a succeeding issue. Photo copyrighted by Hamilton Maxwell, Inc., New York City

Hints and Helps for Superintendents

Suspension Bridge of Old Cables

WIRE ropes which have outlived their usefulness in dragline operations and the like, may still be of service about the plant, and a number of uses for them have been published in this department. A quite obvious use for such old cables, where the necessity for such a thing exists, is to make a suspension bridge of them.

The views show the details of such a bridge at the plant of the Indiana Gravel Co., at Indianapolis. The bridge is perhaps 50 yd. long and spans Fall Creek, which divides the sand and gravel plants from the main office. Consequently there is plenty of travel over this bridge.

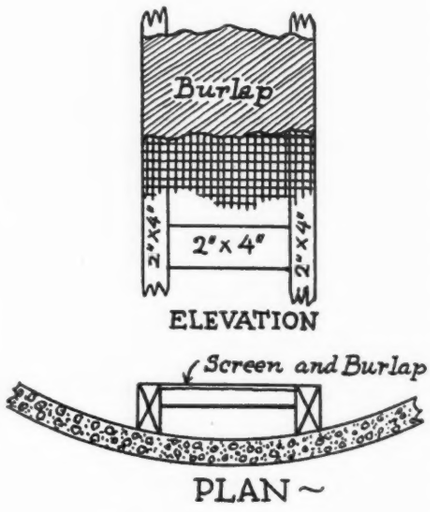
The construction is quite simple. The main catenary cables are old dragline cables, of 1¼-in. diameter. These are the ropes on which the bucket travels. Pieces of the smaller traveller cables are used to support the walkway. These are looped over the catenary cables and brought down through a piece of 2x4-in. timber. The walkway, which is two planks wide, is laid on these pieces of 2x4 stuff.

The towers are simply constructed of 8x8-in. timbers set in the ground and the catenary cables are anchored to "dead men" behind them.

There is considerable movement to such a bridge that gives the novice an uneasy sensation, but one soon becomes used to it and carpenters cross it bearing long planks and tools without hesitation.

Draining a Sand Bin

IN a plant producing washed sand and gravel trouble is often found in draining the sand. This is especially the case where bins of the silo type of steel or reinforced concrete are used. With old wooden bins a good deal of the water finds a way out through the boards, but with tight bins the water must all filter through the sand to the bottom unless some drainage channel is provided.



Method of draining bin

The sketch shows a method of draining the concrete silos used for wet sand at the plant of the Granite Sand and Gravel Co., Indianapolis, Ind. Two pieces of 2x4-in. timber are fastened on the inner wall of the silo about a foot apart. They are connected at short distances by other pieces of 2x4-in. placed so as to leave a space between them and the silo wall.

On these pieces of 2x4 a galvanized wire screen is nailed and on this strips of burlap. Thus a filter channel is provided from the top to the bottom and any water on top of the sand runs off through this channel instead of filtering through the sand to the bottom. A hole is cut through the silo wall at the bottom through which the water that flows down through the filter channel escapes.

It is important to drain sand bins as these are not usually designed to resist the pressure of saturated sand. Saturated sand (quicksand) "has the properties of a liquid of the same specific gravity as the specific gravity of the mixture." Put in simpler words this means that the pressure of saturated sand is as much greater than the pressure of water as it is heavier than water. A thoroughly saturated sand weighs about 1.8 times as much as water and hence has 1.8 times the pressure. Dry sand has less pressure and damp or drained sand has so little pressure that it will sometimes stand like a wall if a side of the bin is removed.

Left—Showing construction of bridge. Right—One of the towers

Fastening Crushing Roll Shells

By W. J. TAIT

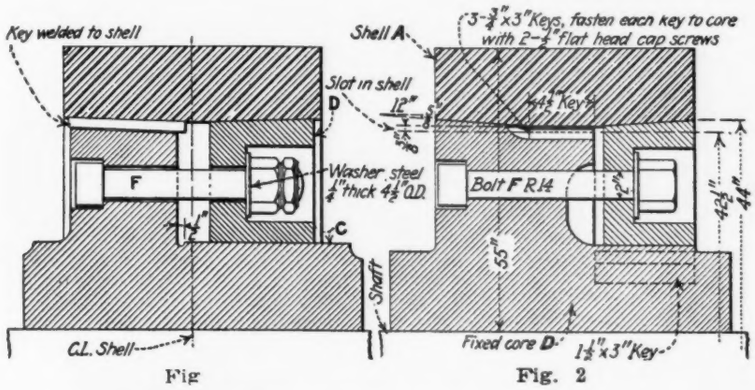
Contributed to "Engineering and Mining Journal-Press"

THE practice that is followed in fastening roll shells at the Timber Butte mill, Butte, Mont., as described in the following, has been developed over a period of time, and has successfully met some of the problems involved in fastening roll shells. The rolls are 55x18 in. and are employed in crushing a feed of ¾-in. to 1-in. in size through ⅛-in. mesh screen in a closed circuit with screens. They were originally furnished with the usual tight and loose cores for shrinking on the shells. One-piece cores and single-taper shells were also tried. The practice was to shrink 0.001 in. per inch in diameter, and this shrinkage was gaged by setting the cores and shells tightly together, heating the shell and driving up the cores to a measured distance.

At times difficulty developed from the roll shells slipping or breaking when they were still of a considerable thickness. This was due to the shrinkage being too little or too great. Much breakage was also caused by the employment of inexperienced men and the tendency to rush the job without proper care in fitting. The fire risk necessitated doing the work outside of the mill building, and severe weather always brought about complaint from the men. The shells, by slipping, destroyed the faces of the cores and thus necessitated core renewals, as shims are very difficult to hold when the core faces become worn. The method of fastening by wooden wedges was tried, and one set of cores that were turned down for the wedges is still in use and gives satisfaction when the shell is carefully wedged.

It was thought that a key for positively driving the shell with the cores supporting the crushing load should prevent both slipping and premature breakage, since the shell would be under tension from the shrinkage. The first plan tried was the building up of a key on the inside of a shell by arc welding. Test pieces were made and tried out under the steam hammer. The most successful of these were made by filling between two strips of steel clamped on the shell. The strips furnished edges and faces on the key without the necessity of machining. In breaking off the keys under the hammer, the keys pulled away part of the original shell with them. The keys put on the shells were 3 in. wide and ¾ in. in height, a keyway being cut in the fixed core. See Fig. 1. The loose core was rammed up tight and held by the core bolts. The first of the shells fastened in this way broke at the key, the thickness of the roll shell being about 1¾ in. Inspection seemed to indicate that the welding process altered the structure of the shell under the key. The second shell wore down to about 1 in. in thickness when it was discarded. Inspection showed that a crack had started in this shell at the key.

Our present plan is to use a central rib and three keys fastened to the fixed core by flat-headed capscrews, Fig. 2. Corresponding keyways or slots are cut in the roll shell, Fig. 3. The shell is rammed right on the fixed core; the loose core is rammed tight into the shell, and the bolts through the cores are then drawn up. The plan has been very successful.



Fig

Fig. 2

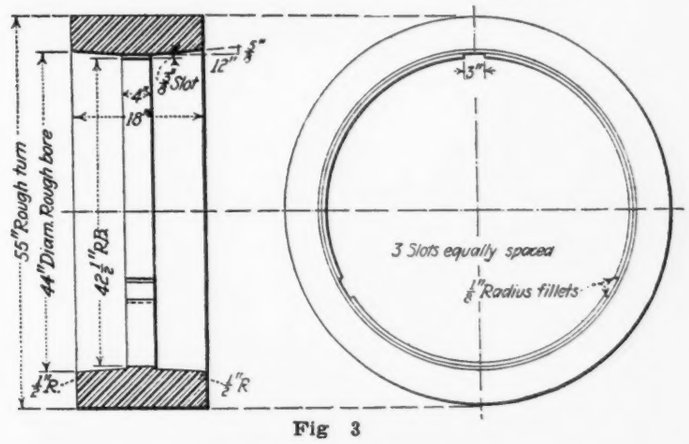


Fig 3

How the roll shell is fastened

Protecting the Dragline Hoist Operator

RUNNING a cableway dragline in winter is often an unpleasant job. There has to be left an opening in the building through which the ropes can pass and through which the wind also passes very easily.

The picture shows how the dragline operator at the plant of the Indiana Gravel Co. made himself comfortable in the winter weather. A tight board partition was put between the hoist and the control levers, which are at the side of the hoist in this type. A window in the partition beside the operator's seat permits him to look at the hoist and see that everything about it is as it should be. Other windows in front of him and at the side permit him to watch the entire operation of the filling and emptying of the bucket.

Partition keeps out the cold

The hoist is of the two-speed, two drum electric type. With a steam hoist there was always plenty of heat so no partition of the sort described here was necessary.

A small stove has been placed on the operator's side of the partition so that he may work in comfort in the coldest and windiest weather.

Cost Accounting in the Cement Industry*

Getting the Essential Figures in Spite of Complications

By O. N. Lindahl

BY way of getting across quickly that it costs considerable to manufacture cement, it should be borne in mind that it takes about 600 lb. of raw materials, from 150 to 200 lb. of coal, approximately 18 kilowatt hours of electrical energy and considerable labor to produce one barrel of cement. It takes about one hour of man labor to manufacture approximately two barrels of cement. To the total sum of the above items should be added all the necessary overhead expenditures such as taxes, state, local and federal; depletion, depreciation, repairs, administrative and selling expenses, advertising, tools, lubricants, cost of packing and loading cement from the bins into cars, cost of counting, inspecting and sorting and mending returned cloth sacks and many other smaller items, which, in the aggregate, make quite large sums.

The process of manufacture starts with the quarrying of the raw materials used, such as limestone, shale, clay, etc. These quarries are usually located in the proximity of the plant. In some few cases the cement companies do not own their own quarries, which necessitates the purchasing of raw materials, which eliminates the first operation. No cement mill should be built which has not in sight at least 25 years' supply of raw materials, either through operating its own quarry, leasing a quarry, or knowing where raw material can be procured at a reasonable cost for this period of time.

Quarrying

As the first steps in the manufacture of cement consist of quarrying, the accounting for this particular unit necessarily comes first. It is a fact that very seldom is the same amount of raw material quarried as is burned into clinker in any given month, and likewise clinker is burner either in greater or lesser quantities than the raw material quarried in any month, which results in adding to the inventory of raw material or taking away from this inventory if less or more than produced is burned. The whole year's supply of raw material may be quarried in six months and, if such is the case, it should be thrown into inventory at its quarrying cost and used up from inventory at its inventory price, so as to have final cement cost indicative of true operating conditions. Likewise in the case of burning clinker, if more is burned in any one month than is ground, the excess should be placed into inventory and used up at its inventory value when later it is ground up. This gives a correct manufacturing cost throughout the year, if outside influences from one period to another in the year are not too great.

*From the February, 1925, issue of "Industrial Management," by special permission.

O. N. LINDAHL has been associated with the Universal Portland Cement Co. since 1910; as Chief Accountant for the first four years, and since then as Auditor. Prior to his association with that company, he was in the Cost Department of the Illinois Steel Co. for four years.

In 1919 and 1920 Mr. Lindahl was President of the Illinois Manufacturers' Cost Association, serving on their Executive and Advisory committees since that time. He has been a member for the past ten years of the Accounting Committee of the Portland Cement Association, and is a member of the National Association of Cost Accountants.

The first operation, as stated before, starts with the quarrying of raw materials and follows through to the final process of finished cement. In order that this may be placed before the reader intelligently, a chart is herewith presented which directs the flow of manufacturing accounts from the distributive accounts to the cost ledger from where they are transferred to the manufacturing accounts in the general ledger. This need not be dwelt upon here because the chart explains better than words can how the processes follow through.

However, it might be well to state here that the general ledger accounts under Manufacturing Expenses of Quarrying, Raw Grinding and Clinker Burning at the end of the month are closed out to Inventory and so carried as partly, or semi-finished product. These accounts are later credited and Clinker Grinding Department is charged, from where it comes out as a finished product of cement and charged to Cement Inventory Account.

Methods of Determining Monthly Production

It is well to bring out here the methods of arriving at the production of cement for the month. The finished product is weighed by weightometers as it comes out of the tube mills on its way to the bins. The scales upon which the product is weighed are so accurate that the variation between weightometer figures and actual inventory does not vary over one-half of one per cent. A good many mills do not have weighing machines and, where this is the case, the following method is used to arrive at the production. Cement manufacture is a continuous operation. So many tons of raw material are fed into the operations and so many barrels of semi or partly finished and finished product come out at the other end. At the end of the period the company engineers go out and measure the inventories, taking into consideration the peaks and valleys in the pile. To this inventory is added the shipments for the month, from which the inventory on hand at the beginning of the month is deducted, which gives the production for the month. These figures are further tested by the amount of raw material fed into the raw mills at a known number of barrels of product per revolution of the various feed screws of the tube mills. The pounds of raw material consumed per barrel are then checked against previous productions to see if operating conditions are running uniformly. The foregoing method has been improved considerably of late by the installation of scales which weigh the manufactured product and which obviate the necessity of measurements.

Unusual Items

There are some unusual items which call for an explanation, such as:

- *(a)* Accounting in connection with waste heat boilers.
- *(b)* Packing and loading.
- *(c)* Sack handling, which includes the cost of counting, inspecting, cleaning and repairing empty sacks returned by customers.
- *(d)* Cafeteria accounting and the operation thereof.
- *(e)* Lodging houses.
- *(f)* Shutdown expense.
- *(g)* Accounting for sacks.

The most important of these items are probably the first and the last; the waste-heat boilers and the accounting for the difference in price of new sacks shipped between the cost thereof and the billing price. In connection with the accounting for waste-heat boilers, there are three ways that this might be done with the same results, they are:

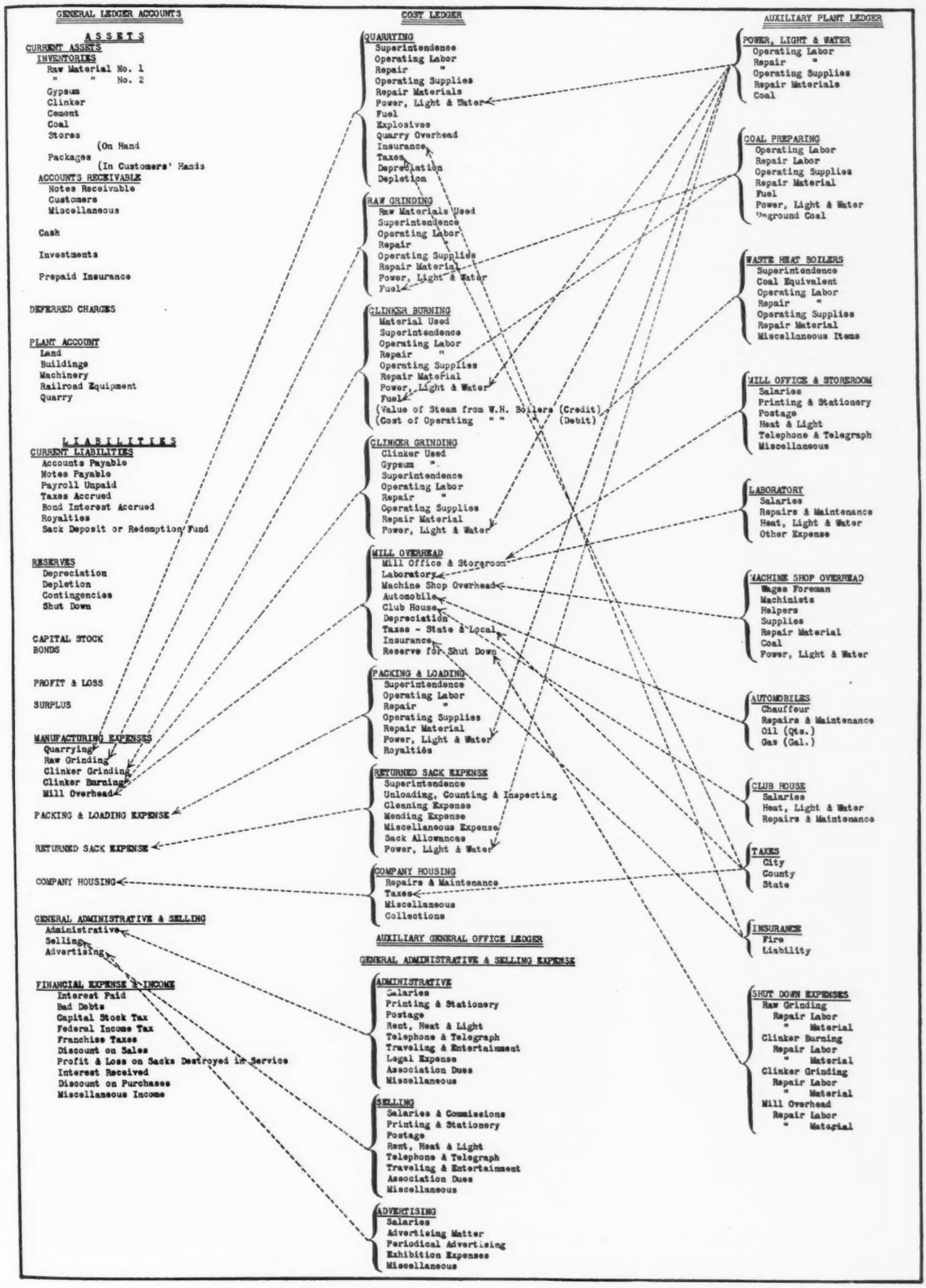


Diagram showing distribution of costs in the manufacture of portland cement

(a) Taking no recognition whatever in the accounts for any by-product, but letting the heat from the waste gases fire the boilers and let the energy created by the steam driving the turbines, which generate the electricity, go back into the power costs, with the result that a very cheap power is shown on the cost sheet.

(b) This method takes into consideration that the product of the waste-heat boilers is electrical energy, and when this method is used it it necessary to determine the number of kilowatt hours of electrical energy generated during the month, which resultant credit is shown on the Clinker Cost Sheet as electrical energy generated, from which is deducted the cost of operating waste heat boilers, which leaves a net gain from the energy received. In the Power caption on the Clinker Cost Sheet the full amount is charged for power based on the number of kilowatt hours generated. The assumption is that it takes 2.4 lb.* of coal per kilowatt hour; this is extended into tons and figured on the basis of coal at the current market price.

(c) Or the third method, which, in the writer's opinion, is more indicative of correct operating results than the two already given, for the reason that it considers steam as the product rather than electrical energy, because that is what is produced to drive the generators. This steam drives turbines that in turn generate the electricity. In order to arrive at a fair rate per b.h.p. for steam, the cost at which steam is or could be produced in a modern steam plant in that particular locality is used as a basis for this cost; this b.h.p. rate then should be multiplied by the number of b.h.p.'s in the month to get the credit value of steam from waste heat boilers. From this gross credit should be deducted the cost of operating waste-heat boilers and which, if deducted from the value of steam, will give the net saving in total money per unit of product in the operation of the waste-heat boilers. This results in charging into the Power Costs on the Clinker Cost Sheet, a figure which is approximately what it costs to either purchase power from the outside or generate it in one's own power station.

The Method of Accounting for Waste Heat Boilers

A great deal of controversy exists as to which of the three methods described should be used in accounting for waste-heat boilers. The consensus of opinion in the cement industry is that the "A" method should be used, but the writer believes, from his experience, that the "C" method should be given preference as that reflects more nearly what is actually happening than any other. There is no question whatever, regardless of what anyone says to the contrary, that steam is the product and if that is the case then the accounts should so reflect it. Regardless of which of the three methods suggested is used, the final net results on the Cost Sheet will be practically the same. The only question that presents itself is which of the three methods more truly reflects actual operating conditions and when that is determined, that method should be given preference over the others.

*Mr. Gerard Swope, President General Electric Co., in an address delivered in 1923.

Accounting for Sacks

The treatment for handling the accounting in connection with the shipping and returning of the cloth sack has been a troublesome one. It has always been quite a problem, but this problem seems to have at last been solved. To get the right perspective, it should be borne in mind that some cement companies sell their cloth sacks to the customer with the cement for 10c. each; while other companies lease the sack to the customer for 10c. In either case, however, the agreement is that they are to be returned to the cement company within a certain specified time, when upon such return the customer will be repaid 10c. for each good and repairable sack so returned. With this statement of understanding on the part of the cement company with its customers, the accounting should then be considered.

Cement companies at the present time are paying about 20c. for each new sack purchased from the manufacturer; these sacks are shipped out to the customer for 10c. each. From this transaction it appears on the surface that the cement company has lost 10c. for every sack shipped to the customer. This, however, is not a fact because about 90% of the sacks shipped out are returned by the customer and the original deposit of 10c. per sack is returned to him. With this in mind, we should consider the accounting procedure. Let us take as an illustration a company leasing its sacks to the customer—for this article assumes that the average inventory price for all sacks on hand in the cement company's inventory is 20c. per sack and that the charge to the customer is 10c.; the following accounts should be opened up in the General Ledger:

Sack Inventory Account,
Sacks in Customers' Hands,
Customers' Accounts Receivable,
Sack Deposit or Redemption Account,
Profit and Loss on Sacks Developed Useless, and
Profit and Loss on Sacks Destroyed in Service.

All old and new sacks in inventory should be charged to the Sack Inventory Account at an average price, which, for this purpose, is 20c. per sack. As sacks are shipped, the first entry is a transfer by journal from the Sack Inventory Account to the Sacks in Customers' Hands Account at the average inventory price of 20c. per sack. This entry is made solely for the sake of distinguishing the inventory of sacks on hand at the mill from those in the hands of the customer at the end of a period.

At the end of the month (in view of the fact that in the customers' invoice there is a leasing charge of 10c. for each sack) in the recapitulation of the Sales Journal the total of the invoice, including the 10c., is charged to the Customers' Sales Ledger Account while the credit is split to Cement Trading Account or, in some cases, to Profit and Loss Account and Customers' Sack Deposit Account. This latter account appears on the Balance Sheet as a distinct liability under Current Liabilities; it is placed there because of its current nature rather than under Reserves.

This Sack Deposit Account stands until the sacks are returned by the customer, when a specific liability to the individual customer should be entered on the books, or check or draft drawn in favor of the customer and charged to the general liability account—Customers' Sack Deposit or Redemption Account. Another entry is then made charging back to Sack Inventory Account and crediting Sacks in Customers' Hands with the number of good and repairable sacks returned at their average inventory value. Auxiliary accounts are kept to show the number of sacks outstanding in the hands of each customer, which (after allowances have been made for those that will not be returned) total should equal that shown by the controlling account—Sacks in Customers' Hands.

The Item of Returned Sacks

There is another item, too, that must be considered at the end of each month and that is the useless sacks which are returned by the customer for which he is not allowed credit; this item should be handled as follows: At the end of the month the Customers' Sack Deposit or Redemption Account should be charged with 10c. each for all useless sacks returned and Sacks in Customers' Hands should be credited at the average inventory price of 20c. each, and the difference of 10c. should be written off to Profit and Loss on Sacks Developed Useless.

Another item to be considered in this sack question is the accounting for the number of sacks which become useless in the hands of customers and are never returned. Cement companies have correct figures on this percentage, each according to its own experience, and range all the way from 8% to 15%, but for this purpose we will use a figure of 10%. Ten per cent (10%) of the sacks shipped should, therefore, be written out of the accounts immediately upon shipment. Sack Deposit or Redemption Account should be charged at 10c. each for 10% of the sacks shipped, Sacks in Customers' Hands credited with the same number of sacks at an average inventory price, or 20c., and the loss of 10c. per sack on this 10% of shipments charged to Profit and Loss on Sacks Destroyed in Service. The foregoing entries are made on the basis of present prices for cement sacks, which are probably in excess of the selling or leasing price. Should the cost of sacks to the cement company be less than 10c. per sack,

the result will be a reversal of some of the figures.

In the explanation of this cost system it should be borne in mind that there is a distinction between the accounting for shipping and returning cement cloth sacks with that of the actual operation of counting, cleaning, mending and handling these sacks after they are returned to the mill. These operating items at the mill are taken care of in the regular Cost Sheet as shown on the chart. The item of Packing and Loading, which is that of filling cement from bins into cement bags and loaded onto cars, is another expense which the chart shows just how it follows through the accounts.

Shut-Down Expense

Another item worthy of mention is the shut-down expense. In the past this item has been treated as an item chargeable to Shut-Down expense as it occurred, but a more conservative way, which has been approved by the best minds in the industry, is to set up a reserve at so much per barrel when the mill is running to take care of these shut-down expenses when they actually occur. This is a departure from what has been considered good accounting heretofore, yet the writer feels that in order to be abreast of the times this change is a step in the direction of perfection in accounting.

There are many things to consider in the accounting problems of a cement mill, such as the handling of the accounts in connection with the cafeteria, lodging houses, privately owned box cars, etc. These properties should in theory at least break even and possibly earn an amount equivalent to a fair interest on the investment. It is an exception for any of these items to do this; instead of making money they usually show losses which are a source of worry to the management. However, as they are a necessary requisite to the successful running of a plant, they must be taken into consideration in the fixing of a cost for the finished product; yet, when those unfamiliar with the accounting practice of the cement industry try to arrive at the cost of the finished product, they usually leave these items out of their considerations.

Depreciation

Depreciation is a much misunderstood problem in the cement industry, for the reason that all the facts in connection with it are not known. To get the right perspective on this important item, one should always have in mind:

(a) The cement business is one of continuous operation, 24 hours a day and 365 days a year.

(b) Machinery is of an unusually heavy type, with large electrical units, requiring a heavy investment.

(c) Heavy gritty raw materials pass through this machinery causing it to wear out rapidly.

(d) Resolves itself into the fact that the cement business is one requiring a heavy rate for depreciation to offset this wear and tear by continuous operation on high priced equipment by material that wears it out rapidly. This fact is usually overlooked.

Over-stating Production

There is one particular point in connection with the auditing of the cement business that requires special and careful attention and that is that care should be taken that the production and inventories are as stated by the Engineering or Production Department at the end of any period. Sometimes, in order to make a showing for production, the engineers in charge will estimate more than what was actually produced, which will result in a low cost; the next month, however, there is developed a shortage which results in a high cost for that month. One of the most important duties of an auditor in the cement business is to see that these reports are right. Great care should be used and tests taken from time to time to get an idea as to what the feed screws are doing per revolution and that the raw material used is running true to past performances. This applies only to companies who have not yet installed weighing machinery for the recording of the finished product as it comes out of the tube mills and goes into the bins.

As in other industries, a great deal of care should be taken to see that expenditures are properly applied, those applicable to capital, those to up-keep and other accounts charged correctly. There is a great danger in misapplying some of these expenditures if one is not very careful.

Study of this article, and application to the chart, will give a fair understanding of some of the accounting problems connected with the cement business. No attempt has been made to show in detail how the various Journal Vouchers and forms are made up and handled, because the writer thinks that is elemental and for the beginner and need not be discussed in an article of this kind.

Petoskey Portland Cement Co. Sells Agricultural Limestone

ARRANGEMENTS have been made with the Petoskey Portland Cement Co. of Petoskey, Mich., whereby a good quality of finely ground limestone can be shipped in bulk in carload lots, according to the *Cite* of Boyne City, Mich.

Michigan farmers in general appreciate the value of the use of limestone on the soil and ten carloads of limestone have already been distributed in Wexford county and other counties are doing the same. A cash price of $2.50 per ton bulk has been made for all points in Charlevoix county and arrangements are being made for co-operative buying.

Belgian Portland Cement Prices for December

THE average wholesale prices in Belgian currency governing exports of cement (including containers, packing, transportation, insurance, and generally, commission charges) were approximately 180 francs per metric ton, f.o.b. Antwerp, during the month of December, 1924. Dollar quotations on exports to the United States were in the neighborhood of $9.50 per 24 sacks f.o.b. Antwerp, which is a little over one ton. Prices quoted on exports of cement to the United States, as shown by consular invoices certified during December varied considerably. According to the records at Brussels, the average price was $8.19 per ton f.o.b. Antwerp, while prices ranged between $4.73 and $8.71 per ton. The quotation of $4.73 per ton covered a shipment for which the importer furnished the bags. The Ghent district made one shipment during the month, 4,000 bags, quoted at $2.10 per 4 bags or $11.18 per ton. Shipments from Antwerp during December ranged between $0.46¼ and $0.63 per bag. One shipment alone amounted approximately to 6,450 tons and was invoiced at $9.74 per ton, c.i.f., Philadelphia. The majority of the other shipments were made at $0.55 per bag, or $11.70 per ton, f.o.b., Antwerp.—Consular Reports to the U. S. Department of Commerce.

Operation Plans for South Dakota's State Cement Plant

SALES policies, freight rates, minor changes and general problems of the South Dakota state cement plant were discussed recently at a meeting of manager Paul Bellamy and State Senator Verne Kennedy, consulting engineer.

The two men discussed the changes that will be made in the plant when the new mill is shut down for three or four weeks to take an inventory of progress and needs.

Both agreed that the changes will be very minor, but all machinery will be carefully looked over to determine extent of wear and likelihood of repairs being needed.

"Every large plant needs to shut down after it has gone through its initial operating stage in order to make a survey and to make small adjustments," declared Mr. Kennedy. "It's just good business policy."

With the receipt of orders for 10 additional carloads of "Dacotah" cement the time when the stock-house will be filled to permit the shutting down was slightly postponed.

Repairs for the stock-house are not included in the things to be done while the mill is shut down, it was said. A new base for the building must be put in but this will not be done until later when all frost is out of the ground.—*Sioux Falls (S. D.) Press.*

Financial News and Comment

Charles Warner Company Annual Statement

OUR business was active during the year 1924, mainly through the continuation of the building construction work throughout the country. The agricultural demand for our products showed some little improvement but not as much as had been expected. However, the recent general improvement in all business lines and the balancing of the purchasing power between the construction, manufacturing and agriculaural interests of our country, seem to assure excellent all-around demand for our products for the year 1925.

During the past year, as partly prophesied in the last annual report, our company undertook an extensive development of its sand and gravel interests. Your directors deemed it advisable to accomplish coincidently two major steps:

First, to centralize our production of sand and gravel at one modern plant capable of more economical operation than the three old and overloaded dredges that would be replaced. The new plant will have a daily capacity of about 10,000 tons which should be large enough to provide for present and reasonable future needs. To support this large plant and to meet the condition of exhausting river deposits, it was thought proper to acquire full ownership of extensive acreage of sand and gravel adjacent to the Delaware River. It was also considered desirable to round out our capacities and distribution by acquiring a going plant producing sand and gravel products on the line of the Pennsylvania Railroad.

This combination of needs led to the second step in the 1924 program, by purchasing the Penn Sand & Gravel Co., with its operating plant located on the Pennsylvania Railroad between Bristol and Trenton, and its ownership of extensive sand and gravel deposits located both on the railroad site and on our river site three miles distant. The combined acreage of our old and new deposits in this region now amounts to approximately eleven hundred acres of proven material.

These steps have all progressed satisfactorily without interfering with our current operations and profits.

The major portion of these extensive capital outlays had to be provided from the sale of bonds and stock, all of which was successfully consummated. The company has easily carried its increased interest and dividend charges during the year with a substantial surplus remaining, although the large capital outlays for the construction of the new plant, with resultant increase in interest charges, contributed nothing to earnings.

During the past few months we have added to our marine fleet ten new barges of large capacity for the more economical handling of our 1925 tonnages. This new equipment will in part replace small capacity and high cost barges and will in part provide for the growing demand on our river tonnages.

These various capital outlays in the upbuilding of our Sand and Gravel Department give reasonable promise of adding substantially to the net profits of the company during the years to come and were essential to the proper development of our business in order to keep our company to the front as large scale producers and distributers of our major products, lime, sand and gravel.

Introduction

BEGINNING with this issue this page will be a regular feature of Rock Products. The editor's aim to make it as accurate and up-to-date as possible, and to do this effectively calls for cooperation on the part of producers and manufacturers. This we earnestly solicit —as well as suggestions and criticism.—The Editors.

GROSS SALES

	1922	1923	1924
Lime products	$1,077,785	$1,260,618	$1,196,843
Sand & gravel	816,485	1,087,874	1,315,293
Cement	152,080	188,929	158,975
Other building material	147,490	187,486	170,609
Miscellaneous	16,053	29,112	96,202
	$2,209,893	$2,754,019	$2,937,922

INCOME STATEMENT

For Year Ended December 31, 1924

Total earnings after deducting all expenses incident to operation, inclusive of general expenses, ordinary taxes, insurance, rentals and maintenance		$547,222.07
Deduct—		
Net credit losses	$ 1,454.60	
Depreciation	142,640.00	
Depletion	30,287.75	
Net interest	30,067.05	
Allowance for federal tax	40,000.00	
		244,449.40
Balance to credit of surplus, available for dividends, etc.		302,772.67
Dividends paid to holders of first and second preferred stock		57,633.56
Balance available for distribution to common stock holders or other purposes		$245.139.11

CONDENSED BALANCE SHEET

December 31, 1924

ASSETS

Cash	$ 279,502
Accounts receivable	270,860
Merchandise (cost)	195,666
Securities	145,518
Real estate, buildings, kilns, structures, equipment, motor trucks, horses, wagons, tugs, dredges, barges and development	4,072,133
Miscellaneous & deferred	120,907
	$5,084,586

LIABILITIES

Accounts payable	$ 71,996
Bills payable	None
Accrued accounts, including common dividend payable 1-10-25, preferred dividend payable 1-22-25 and Federal tax	114,004
Convertible gold bonds	700,000
First preferred stock	843,700
Second preferred stock	177,100
Common stock ($100 par value)	500
Common stock (no par value) 79,775 shares	2,429,384
Surplus, reserves and undivided profits	747,902
	$5,084,586

RECENT QUOTATIONS ON STOCK IN ROCK PRODUCTS CORPORATIONS

(These are the most recent quotations available at this printing. Revisions, corrections and supplemental information will be welcomed by the editor.)

Stock	Date	Par	Price bid	Price asked	Dividend rate
Alpha Portland Cement Co.	.....	100	90	95	
Arundel Corporation (sand and gravel)	Feb. 11	100	112	113½	
Arundel Corporation (new stock)	Feb. 11	No par	22⅜	22¾	
Atlas Portland Cement Co.	.....	100	126	129	
Boston Sand & Gravel Co.	Feb. 11	100	70	72	
Canada Cement Co., Ltd.	Mar. 16	100	103	104	
Canada Cement Co., Ltd. (preferred)	.....	.....	.....	.....	
Charles Warner Co. (lime, crushed stone, sand and gravel)	Feb. 11	No par	19	21	
Charles Warner Co. (preferred)	Feb. 11	100	99	101	
Giant Portland Cement Co.	.....	.....	19¾	20	
Ideal Cement Co.	Mar. 16	No par	55	57	75c Mar. 31
Ideal Cement Co. (preferred)	Mar. 16	100	.....	.....	1¾% quar. Mar. 31
International Cement Co. (common)	Mar. 16	No par	55½	56	$1 Mar. 31
International Cement Co. (preferred)	.....	100	.....	.....	1¾% quar. Mar. 31
Kelley Island Lime & Transport Co.	Dec. 31, 1924	100	102	104	2% quar.
Lehigh Portland Cement Co.	Feb. 13	.....	67	69	
Missouri Portland Cement Co.	Mar. 16	.....	42	42½	
Pacific Portland Cement Co., Consolidated	Mar. 15	100	88¼	.....	
Santa Cruz Portland Cement Co.	Mar. 15	100	103½	.....	6% bonds
United States Gypsum Co. (common)	Mar. 16	No par	116¼	116½	40c quar. Mar. 30
United States Gypsum Co. (preferred)	Mar. 16	100	115	115	1¾% quar. Mar. 30
Wolverine Cement Co.	Mar. 16	.....	.....	13	

Editorial Comment

Producer "Pays the Freight"

A provision of the revised specifications of the American Railway Engineering Association for crushed stone ballast, printed elsewhere in this issue, reads: "As it is impracticable to inspect all the ballast loaded in cars, carloads of defective material arriving at the site for unloading, and not previously inspected, shall be rejected and returned to the manufacturer, who must pay the freight charges both ways." It looks as though the engineering departments of the railways were working "in cahoots" with the traffic department to increase revenue at the expense of the unsuspecting crushed-stone producer—who, by the way, is justly recognized in this clause as a "manufacturer."

Testing Concrete for Highways

There is a growing tendency among highway engineers to judge the value of concrete for highway purposes by its resistance to bending rather than compression, and hence to put the flexure test and modulus of rupture obtained by it ahead of the resistance to pressure in pounds per square inch. This seems logical for experience is that concrete roads fail mainly by breaking off at the edge or corner of a slab. The modulus of rupture, which is defined as "a measure which represents a combination of all the forces which tend to break a beam," would seem to be the important figure in this connection. However, there are highway engineers who do not care to see a change made. The engineering world has trained itself to judge concrete by its compressive strength and to classify it as 1500 lb., 2000 lb., or 3000 lb. concrete. As a practical matter the cost of a flexure test is considerably greater, one engineer setting the figure at four to five times the cost of the compression test. But the same engineer admitted that the effect of poor aggregate would show up more certainly in a flexure test than in a compression test.

G. W. Hutchinson, writing in the *Engineering News-Record* for March 12, gives the results of testing highway concrete by impact, made when he was with the North Carolina state highway commission. It is interesting to note that an 8-in. slab had almost twice the resistance to impact of a 6-in. slab. Mr. Hutchinson says that our present standard tests for aggregates are not indicative of the resistance to impact in the concrete containing them. Reduction in the maximum size of coarser aggregates has been found to improve impact resistance, and the impact test is suitable for determining the economic size and type of coarse aggregate to be used.

The Highway Official

In an address before the National Crushed Stone Association at Cincinnati last January, A. R. Hirst, for about 20 years State Highway Engineer of Wisconsin, said: "Be sympathetic toward the poor guy who temporarily sits in the seat of authority in road building." In many cases he needs sympathy but gets "hell." In probably 99 cases out of 100 he is honest and conscientious and tries to be fair, but being human, he is subject to human frailties. That his intentions are good is amply proved by the quotations from many "of him" elsewhere in this issue—a study of which will prove interesting and helpful in getting their point of view; which we must get to sell them successfully.

A producer of aggregate can generally make no more impression on an engineer by telling him what aggregate he should use than he would on a lawyer by telling him how to handle a case in court. There is no strength in an argument that a "commercial aggregate" should be used simply because it is produced by a commercial producer; nor that some other aggregate is worthless simply because it comes from a small roadside pit.

On the other hand there is no class or profession of men easier to convince with sound arguments than these same engineers; because their whole training and experience makes for open-mindedness and logical reasoning. When aggregate producers are so well posted on their own commodity that they undeniably know more about it than the engineers who use it, engineers will be the first to give them a hearing and to give them the respect that every intelligent man gives to those whose knowledge of a particular subject is recognized as greater than his own.

Now there has been a lot of hard reading in some recent issues of ROCK PRODUCTS about concrete aggregates, but it is the kind of information about their products that forward-looking producers must have sooner or later. As Robert H. Ford, assistant chief engineer of the Rock Island Lines, told the recent annual convention of the National Sand and Gravel Association, gravel and stone ballast are about the only things left that the railways purchase in large quantities, the producers of which are *not* far better informed on than the railway engineers. This can't go on and at the same time expect engineers to have the same respect for the gravel and stone industries that they have for other industries.

So, while we could print lots more newsy and interesting articles than some of those referred to, like castor oil, they may be beneficial to you occasionally.

February Output of Portland Cement

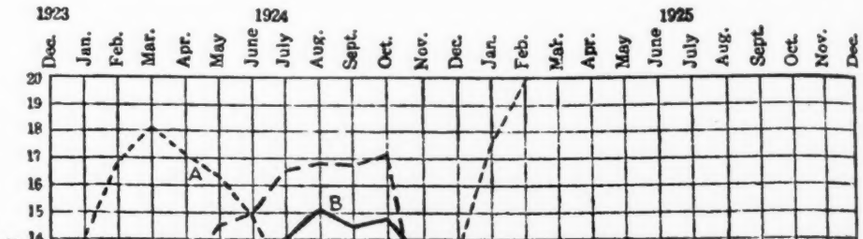
Statistics Prepared by the Geological Survey

THE following tables, prepared under the direction of Ernest F. Burchard, of the Geological Survey, are based mainly on the reports of producers of Portland cement. The February, 1925, totals include estimates for one plant. February production is slightly below that of one year ago and that of one month ago but higher than other preceding corresponding months; shipments are higher than for preceding Februarys and show an upward trend for 1925, and stocks exceed all earlier accumulations.

Stocks of clinker, or unground cement, at the mills at the end of February, 1925 amounted to about 8,486,000 bbl. compared with 7,017,000 bbl.. (revised) at the beginning of the month.

The imports of hydraulic cement in January, 1925, amounted to 229,838 bbl. valued at $361,098.* The total imports in 1924 amounted to 2,010,036 bbl., valued at $3,116,564.

The imports in January were from Belgium, 94,938 bbl.; Norway, 89,367 bbl.; Denmark, 37,991 bbl.; Germany, 2800 bbl.; United Kingdom, 2460 bbl.; France, 1662 bbl.; Virgin Islands, 322 bbl.; Japan, 250 bbl.; Canada, 48 bbl.


1923
1924
1925
Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
MILLIONS OF BARRELS
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
A
B
C

(A) Stocks of finished portland cement at factories. (B) Production of finished portland cement. (C) Shipments of finished portland cement from factories

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN FEBRUARY, 1924 AND 1925, AND STOCKS IN JANUARY, 1925, IN BARRELS

Commercial district	Production—February 1924	Production—February 1925	Shipments—February 1924	Shipments—February 1925	Stocks at end of February 1924	Stocks at end of February 1925	Stocks at end of January, 1925*
E'n Penn., N. J. & Md.	2,600,000	2,486,000	1,361,000	1,490,000	4,067,000	4,746,000	3,749,000
New York	276,000	272,000	129,000	206,000	1,070,000	1,233,000	1,167,000
Ohio W'n Penn. & W. Va.	708,000	593,000	461,000	404,000	1,735,000	1,977,000	1,788,000
Michigan	314,000	453,000	247,000	254,000	881,000	1,185,000	987,000
Wis.,† Ill., Ind. & Ky.	1,276,000	1,240,000	752,000	601,000	2,779,000	3,547,000	2,908,000
Va., Tenn., Ala. & Ga.	753,000	919,000	633,000	780,000	751,000	869,000	730,000
E'n Mo., Ia., Minn. & S. D.‡	921,000	499,000	572,000	389,000	2,868,000	3,248,000	3,138,000
W'n Mo., Neb., Kan., & Okla.	403,000	388,000	436,000	468,000	1,227,000	1,498,000	1,577,000
Texas	363,000	339,000	268,000	374,000	400,000	343,000	378,000
Colo. & Utah	85,000	141,000	117,000	110,000	230,000	372,000	341,000
Calif.	745,000	733,000	818,000	786,000	300,000	472,000	525,000
Ore., Wash. & Mont.	144,000	192,000	139,000	153,000	507,000	407,000	368,000
	8,588,000	8,255,000	5,933,000	6,015,000	16,815,000	19,897,000	17,656,000

*Revised. †Began producing and shipping January, 1925. ‡Began producing and shipping June, 1924. December, 1924, and

PRODUCTION, SHIPMENTS AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1924 AND 1925, IN BARRELS

Month	Production 1924	Production 1925	Shipments 1924	Shipments 1925	Stocks at end of month 1924	Stocks at end of month 1925
January	8,788,000	8,916,000	5,210,000	5,108,000	14,155,000	*17,656,000
February	8,588,000	8,255,000	5,933,000	6,015,000	16,815,000	19,897,000
March	10,370,000		8,995,000		18,189,000	
First quarter	27,746,000		20,138,000			
April	11,726,000		12,771,000		17,159,000	
May	13,777,000		14,551,000		16,403,000	
June	13,538,000		15,036,000		14,903,000	
Second quarter	39,041,000		42,358,000			
July	14,029,000		16,614,000		12,319,000	
August	15,128,000		16,855,000		10,666,000	
September	14,519,000		16,827,000		8,404,000	
Third quarter	43,676,000		50,296,000			
October	14,820,000		17,160,000		6,073,000	
November	13,141,000		10,289,000		8,928,000	
December	10,435,000		5,506,000		13,913,000	
Fourth quarter	38,396,000		32,955,000			
	148,859,000		145,747,000			

*Revised.

The imports were received in the following districts: Porto Rico, 38,313 bbl.; Philadelphia, 35,375 bbl.; Los Angeles, 33,432 bbl.; Hawaii, 30,038 bbl.; Florida, 24,187 bbl.; San Francisco, 20,619 bbl.; Oregon, 14,959 bbl.; New Orleans, 13,523 bbl.; South Carolina, 8996 bbl.; other districts, 10,396 bbl.

The exports of hydraulic cement in January, 1925, were 71,596 bbl., valued at $207,547 of which there was sent to Cuba, 34,052 bbl.; to the other West Indies, 1085 bbl.; South America, 13,557 bbl.; Mexico, 12,736 bbl.; Central America, 7740 bbl.; Canada, 58 bbl.; and to other countries, 2368 bbl. These exports are exclusive of shipments to

IMPORTS AND EXPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1924 AND 1925 IN BARRELS*

Months	Imports 1924	Imports 1925	Exports 1924	Exports 1925
January	153,839	229,838	88,586	71,596
February	162,930	†	62,606	†
March	160,517		91,224	
April	148,137		83,200	
May	161,304		88,850	
June	196,655		74,064	
July	108,944		60,139	
August	192,634		85,883	
September	138,369		69,470	
October	214,987		79,180	
November	198,806		42,490	
December	173,814		52,851	
	2,010,936		878,543	

*Compiled from records of the Bureau of Foreign and Domestic Commerce and subject to revision.

†Imports and exports in February, 1925, not available.

the following possessions: Porto Rico, 14,548 bbl.; Alaska, 2540 bbl.; Hawaii, 361 bbl.

The statistics of imports and exports of hydraulic cement in February, 1925, are not available.

Distribution

The following figures show shipments from Portland cement mills distributed among the states to which cement was shipped during December, 1923 and 1924.

PORTLAND CEMENT SHIPPED FROM MILLS INTO STATES, IN DECEMBER, 1923 AND 1924*

Shipped to—	December 1923 Barrels	December 1924 Barrels
Alabama	131,444	121,826
Alaska	132	173
Arizona	30,181	37,459
Arkansas	42,472	41,627
California	854,226	738,110
Colorado	38,364	38,782
Connecticut	70,338	59,533
Delaware	12,485	7,884
District of Columbia	51,295	41,729
Florida	126,677	263,031
Georgia	63,019	121,333
Hawaii	5,051	1,164
Idaho	31,227	6,036
Illinois	442,063	328,101
Indiana	139,532	121,574
Iowa	67,194	31,141
Kansas	116,693	62,541
Kentucky	59,255	58,064
Louisiana	71,082	61,252
Maine	11,512	8,053
Maryland	107,230	87,137
Massachusetts	147,525	140,103
Michigan	291,359	178,516
Minnesota	119,829	59,101
Mississippi	18,263	33,644
Missouri	124,160	121,461
Montana	4,992	6,923
Nebraska	41,452	28,363
Nevada	1,141	2,681
New Hampshire	20,118	16,176
New Jersey	314,915	290,069
New Mexico	7,821	6,271
New York	941,731	737,623
North Carolina	122,726	126,363
North Dakota	2,067	132
Ohio	307,270	221,142
Oklahoma	138,233	118,645
Oregon	35,561	43,844
Pennsylvania	523,017	436,794
Porto Rico	0	0
Rhode Island	29,055	23,818
South Carolina	41,860	47,310
South Dakota	9,485	3,627
Tennessee	63,956	71,319
Texas	150,139	236,875
Utah	11,382	6,316
Vermont	9,153	4,557
Virginia	85,921	73,039
Washington	82,235	49,976
West Virginia	57,028	47,324
Wisconsin	96,563	55,172
Wyoming	12,516	9,513
Unspecified	24,340	7,203
	6,307,285	5,440,450
Foreign countries	100,715	65,550
Total shipped from cement plants	6,408,000	5,506,000

*Includes estimated distribution of shipments from three plants.

Will Build New West Coast Cement Plant

THE Peralta Portland Cement Co., of San Francisco, Calif., plans to establish a new plant on San Francisco bay, at a point about three miles northeast of San Mateo.

Llewellyn T. Bachman, well known for his activities in the Portland Cement Association, has recently returned from an inspection of various cement plants in the United States and is now acting as superintendent and directing chemist for the company, with temporary offices at 1010 French Bank Bldg., 110 Sutter street, San Francisco. As noted in a previous number of Rock Products, Mr. Bachman had been associated with the Santa Cruz Portland Cement Co , at Davenport, Calif., for 17 years as assistant superintendent, directing chemist and economist, when he accepted his new position with the Peralta company.

Diamond Alkali Building Cement Plant at Painesville, Ohio

THE Diamond Alkali Co. has let contracts for the construction of a $2,000,000 cement plant at Painesville, Ohio, and building operations are started. The operating company at the plant will be the Ohio Portland Cement Co., Inc., whose main office is now maintained in the First National Bank Bldg., Pittsburgh, Penn., with T. R. Evans in charge.

Southland Portland Cement Company to Start Plant Erection

WORK on the construction of the plant of the Southland Portland Cement Co., at Crab Orchard, Tenn., is to begin at once according to a dispatch in the *Nashville (Tenn.) Banner*. James O. Parker, of Chattanooga who has been working on the financing of the plant and the purchase of the necessary property for over two years and who early in his efforts purchased a 9000 acre tract of land at Crab Orchard, has placed orders for the machinery and awarded the engineering contracts, has stated that shale, coal and limestone are so located that practically all of the material for making the cement will be delivered to the plant by gravity.

John W. Davis Argues for Cement Association

CONSTITUTING what are in effect considered test cases as they relate to trade association activities, arguments were made before the United States Supreme Court in the so-called Maple Flooring and Cement Manufacturers' Protective Associations' suits. In both cases the Government is attempting to have the trade associations dissolved while counsel representing the associations put forth arguments for their preservation. By many it is considered that when the Supreme Court of the United States passes upon these two cases a rather definite code will be set up showing what trade associations may do safely within the law. By reason of this fact, business interests are hoping for comparatively early decisions. This seems to be the most practicable means by which the issue may be expected to be determined in the near future.

Efforts in the past to reach anything like definite conclusions have not been successful. There have been conferences on the subject of setting up a code participated in between such Government officials as Secretary of Commerce Hoover with representatives of various trade associations but when it was sought to even broadly outline activities which trade associations might do within the law, it has been found impossible to get the concurrence of the Department of Justice.

During the past year attempts again were made to have the latter assist in setting up standards and while the Department of Justice appeared to be inclined to do so, it never arrived at the actual point of working out the plan. There also was talk of trying a so-called test case, but this met with some objection and so was not done. The nearest approach to it, therefore, is in these two cases which were recently argued in the Supreme Court. Although they were not brought as test cases, their outcome, it is considered, will have the same effect as though they were instituted with this end in view. It is readily conceded that both the present cases may possess elements that are not common to many trade associations, but it is thought that the broad principles that may be evolved from them may be accepted as governing the general practice.

Special interest was shown in the arguments of the cement case. It was heard on appeal by the Cement Manufacturers Protective Association to have set aside a restraining order of the Federal District Court in New York, enjoining the association from continuing a number of trade practices. The association was represented by Attorney John W. Davis. He maintained that if the action of the lower court were affirmed it would be necessary for the Supreme Court to interpret the Sherman law as seeking to place a premium upon ignorance among producers as to what is transpiring within their industry and "to sentence business men to solitary confinement."

It was argued by special Assistant Attorney General J. A. Fowler that practices of the association were intended to give individual members control over the cement market. He argued also that the association maintained a black list and stifled all competition. Mr. Davis said that the Government had failed to produce any evidence to this end or to show that the association had engaged in any illegal practices. He insisted that the manufacturers had not by agreement or by any other means fixed prices or restricted production. On the contrary, he said, the association had only sought to learn the standing of prospective customers, the extent to which there had been duplication of contracts, and to place in available form for salesmen the freight rates applying to cement.

Mr. Davis said that the association had gathered statistics showing stock on hand at the close of the previous month and related data which were entirely proper and were necessary for any wide awake producers to have. It was argued that there was no information circulated among members regarding probable demand or prices or other subjects that would be in violation of law.—*Iron Age.*

Tomkins Cove Stone Company Prepares for Plant Construction

TWO parties of surveyors are running lines and laying out sites for buildings for the new trap rock plant of the Tomkins Cove Stone Co. at Haverstraw, N. Y., and construction will begin soon (see ROCK PRODUCTS, February 21, 1925, p. 67).

Plans for handling the stone call for the erection of a conveyor system and the reconstruction of an old dock just below Haverstraw. The proposed conveyor system would cross the tracks of the West Shore railroad and a news dispatch in the *Suffern (N. J.) Independent* indicates that the company is having difficulty in obtaining this right-of-way.

Work Resumed at Langtry, Texas, Quarry After Fatal Explosion

WORK has been resumed at the crushed stone quarry near Langtry, Texas, betweent San Antonio and El Paso after a week of inactivity following the premature explosion that resulted in the death of seven men and injury to eight others.

The hole that had the disastrous explosion was reloaded and shot off with much trepidation, many of the Mexican laborers refusing to go near the place until after the blast, according to local news reports.

Peter Vincent was appointed superintendent to succeed T. A. Dorris, who was one of the men killed.

Build Limestone Pulverizing Plant at Junction City, Kansas

A PULVERIZING plant to produce limestone for use in asphaltic concrete mixtures, paints and putty manufacture is being installed by the Zeigler Bros. Construction Co. at Junction City, Kan.

The company has a rock crusher already at the site and limestone is obtained from nearby deposits. A local paper reports that the company is lining up a number of contracts with various concerns and expects to ship the pulverized limestone in considerable quantity in the spring, when the installation will be completed.

Injunction Refused Uvalde Rock Asphalt Company

THE United States Supreme Court recently refused the Uvalde Rock Asphalt Co., and W. A. and J. B. Smith, Uvalde county, Texas, an injunction against the Asphalt Belt Railroad Co., restraining it from building a 25-mile road through their property in Zavalla and Uvalde counties, without a certificate of public convenience and necessity from the Interstate Commerce Commission.—*Witchita (Kan.) Beacon.*

Plan Increased Production at Bethany, Mo., Quarry

H. J. RAND has begun operations at his quarry at Bethany, Mo., as usual this spring to furnish crushed stone for road building. Under the present system of production the rock is quarried in West Bethany and hauled by truck to the railroad depot where the crusher is located. The rock is crushed there and shipped to the various destinations.

This method of handling the material is naturally unsatisfactory and Mr. Rand is endeavoring to secure a right-of-way for a railroad spur from his quarry to the tracks of the Chicago Burlington & Quincy R. R. If successful in this attempt, he intends to install a larger crusher at the quarry thus increasing production and decreasing the cost of handling the rock. Local paper reports indicate that an output of 20 carloads daily is planned and that a ready market is assured.

Basalt Rock Company's Plant Leased, Will Be Improved

MARK HEIN and his brother J. H. Hein have taken a 20-year lease on the plant of the Basalt Rock Co., near Napa, Calif., and will immediately expend between $50,000 and $60,000 in improving its equipment, according to the *Sacramento (Calif.) Bee.* The plant already has water and rail shipping facilities.

The Hein brothers have engaged in highway contracting work for the past year in Sonoma county and their temporary crushing plant near Beltain station will be moved to the plant as soon as their contract for the highway between Shellville and Beltain is finished.

General Crushed Stone Company Adds a Plant and Improves Others

THE General Crushed Stone Co., added another stone crushing plant to its chain throughout New York and neighboring states, having acquired that of the Geneva Stone Corporation at Oaks Corners, N. Y. The addition gives the company a total of eleven plants, four of which are in New York, five in Pennsylvania, one in Massachusetts and one in Delaware. The plant in Akron, N. Y., destroyed by fire last summer, has been rebuilt.

The North Le Roy, N. Y., plant has been undergoing improvements and additional equipment has been installed during the winter months preparatory to a busy season. An auxiliary crusher with electric vibrating screens has been added and the old smokestack replaced by a new 100-ft. stack. The LeRoy plant will now have a capacity of 3000 tons of crushed stone daily. During the last season, which was one of the largest in the history of that plant, it had an average output of 80,000 tons a month for four consecutive months.—*Rochester Herald.*

American Lime and Stone Company to Improve Bellefonte Plant

DIRECTORS of the American Lime & Stone Co., a Charles Warner subsidiary, at Bellefonte, Penn., decided at a recent meeting to proceed at once with certain improvements. These include a permanent stone drying system, a temporary pulverized limestone plant, and a pebble lime storage tank of 1400 tons capacity, with complete arrangements for barreling and bagging this product. These additions are all steps towards a plan which has been adopted to increase the capacity of the Bellefonte plant. It is expected that the drying unit will be finished about May 15, and the pebble lime storage by July 1.—*Wilmington (Del.) Star.*

Enlarging South Carolina Granite Crushing Plant

THE Southern Crushed Stone and Granite Co., whose quarry and plant are located along the Southern railroad between Edgefield and Trenton, S. C., are expending $35,000 in enlarging the plant, says W. B. Jamison, secretary, treasurer and general manager in the *Columbia (S. C.) State.*

A new crusher with a capacity of 250 tons per hour has been purchased and will be installed soon. By way of improvement the company is substituting electrical for steam power. The power line will be run to the plant by May 7. Five electric motors are to be installed now and a number added later.

Death of Thomas L. Sturtevant

THOMAS L. STURTEVANT, organizer of the Sturtevant Mill Co., Boston, Mass., died at Quincy, Mass., February 8, 1925, at the age of 84 years. He was born in New York City. He was a graduate of Union College and of the Harvard University Law School.

He had the distinction of being a pioneer in the fertilizer business, and was also a pioneer inventor and manufacturer of fertilizer machinery and equipment. Associated with the late H. W. Bowker, he organized the Bowker Fertilizer Co., of which he was treasurer for many years. While with the company he invented the cage type mill.

He became so much interested in the mechanical part of the fertilizer business that he resigned from the Bowker Fertilizer Co. and founded the Sturtevant Mill Co., in 1883, for the purpose of manufacturing improved fertilizer equipment. Beside developing the double cage disintegrator and the original Sturtevant giant mill, he purchased from England the patent for making rock emery millstones. He was first treasurer, then president and finally chairman of the board of directors of this company.

Cement Products

TRADE MARK APPLIED FOR WITH U.S. PATENT OFFICE

A Plant That Makes Concrete Blocks and Pipes

Indianapolis Concrete Products Co. Specializes on Faced Block and Reinforced Pipe for Highway Work

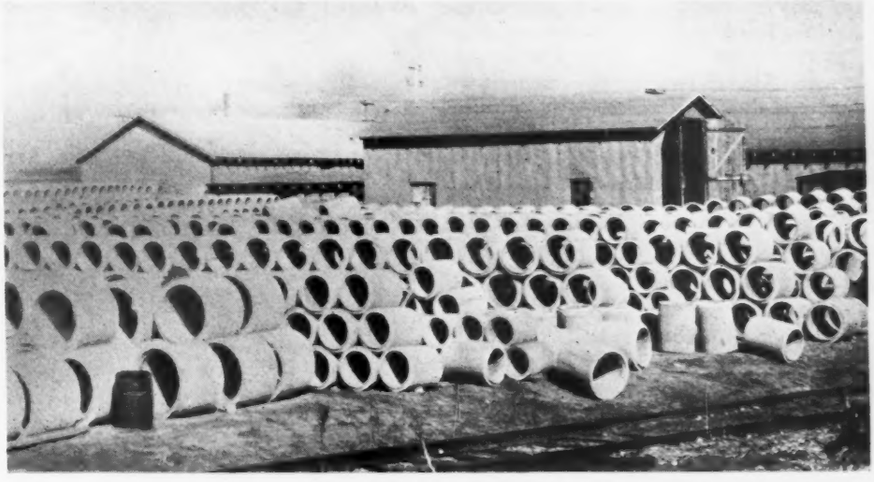
THE plant of the Indianapolis Concrete Products Co., is one of the plants which form a group on the ground of the Granite Sand and Gravel Co.'s land in Indianapolis, Ind. Three of these are concrete products plants, but each has some specialty in which it differs from the others. The Indianapolis Concrete Products Co. specialized in faced block and concrete pipe.

Left—The mixer room in which concrete pipe are molded. Center—Filled molds in the curing room. Right—Molds in curing room and pipe from which molds have just been removed. Note wire reinforcing at left of mold

The block is made with a Universal Junior Machine. The aggregate, which is purchased ready mixed from the granite company, is raised by an elevator to a hopper from which it is fed into a continuous mixer. From the mixer the concrete falls on a chain drag that raises it to the hopper of the block machine.

Many of the blocks are sand-faced, a light colored sand being used which gives them the appearance of a light sandstone. Both plain and rock-cut face blocks are made, and it is a curious commentary on the taste of the public to say that the rock-cut faced block is proferred by the greater part of the plant's customers. Every architectural and building journal in the country has probably condemned these blocks at one time or another for their appearance, which by the unvarying pattern gives the blocks in the wall anything but the appearance of the cut stone they are supposed to imitate. Mr. Harr, the manager of the plant has made very handsome blocks with smooth faces that have an excellent effect in the wall, and has tried to popularize them with his customers, but the old rock-cut face still remains the "best seller."

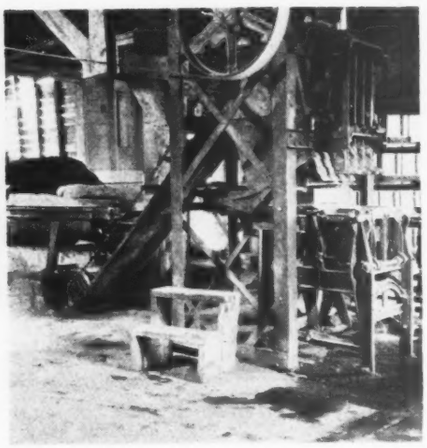
Concrete pipe are not made in a machine, of dry tamped concrete, as blocks are made. They are poured in collapsible steel moulds, the concrete being given sufficient slump to insure that it runs around the reinforcing and fills all the interstices between the reinforcing and the wall of the mould.



Pipe and block plant of Indianapolis Concrete Products Co. The cured pipes in the yard are ready to be loaded in railroad cars which run on the track shown in front

The mix is 1, 1½, 2, the size of the coarse aggregate varying somewhat according to the size of pipe that is being made. The pipes made at this plant are from 10 in. to 30 in. internal diameter. Pipes of larger diameter, from 30-in. up to several feet, are made by another concern in Indianapolis.

The concrete is mixed in a ½-yd. mixer and poured and rammed into the moulds. These are then taken to curing rooms in which they stand until the concrete is hard enough to allow the moulds to be removed. After this they stand in the curing rooms until the hardening is well advanced and then they are moved to the yards for final curing and for storage. Shipments are made from this yard by both railroad cars and motor trucks.



Block machine and part of mixer. The chain drag takes concrete to the machine hopper

The reinforcing is of heavy wire which is woven on a cylindrical form to make a kind of cylindrical basket open at both ends. A portion of the reinforcing for a 20-in. pipe shows in one of the pictures.

Practically all of the output of the plant is used for culverts in highway construction. All of this is carefully inspected and any "seconds" are thrown out. These seconds are sometimes sold at a low price to be used on farms and about homes as drain tile.

In this locality concrete pipe cannot compete with clay pipe if reinforcing is used. The strength of the reinforced pipe, however, makes it especially desirable for highway work, where there is considerable weight to be supported, and here it has practically the field to itself. Unreinforced pipe can compete with clay pipe for ordinary drainage purposes and is sometimes made and sold for such purposes.

The company is endeavoring to educate its customers to use cement mortar with concrete blocks. Many of the "old time" masons prefer lime mortar because they say it spreads easier and allows them to work faster. But as Mr. Harr points out repeatedly to his customers, the use of lime mortar with concrete products robs these of a great part of their strength. The use of

Faced block with plain and rock cut faces curing in yard

cement mortar makes the wall a solid concrete unit from top to bottom; a wall that is able to withstand considerable wind pressure for example, as well as the pressure from the part of the structure above.

The Indianapolis Concrete Products Co. is not an incorporation but is owned by Edward F. Smith of Indianapolis. G. R. Harr is superintendent and manager. The office of the company is near the plant at 2050 South Harding street, Indianapolis, Ind.

Concrete Tables and Benches for Public Parks

IN one way the use of concrete for benches and tables in public parks is an old story, as some of the earliest forms of concrete manufacture were for this purpose. But the market is by no means filled. One finds many parks, especially in the smaller places, in which rotting benches of wood and rusty and uncomfortable seats of cast iron disfigure what should be the most beautiful parts of the city.

Concrete seems especially adapted for park furniture. It has a "natural" appearance and it looks quite in its own place in the grass and among the trees. Probably this is because the eye is so accustomed to seeing statues and rock work in parks, along with face walls and ornamental entrances in cut stone or its modern successor. The concrete tables and benches seem to belong to the same family as these.

To be effective concrete furnishings in a park should be of simple design. Too much attempt at ornamentation looks labored and out of place. In this respect the concrete tables and benches shown in the photograph perhaps go too far. The eflect of so many of them in a group, all of the same design is not pleasing, although a single table with its benches, set in the shade of a tree, would not be unpleasant.

The advantage of such shapes as these, however, is that the form work is very simple and they are sufficiently strong without reinforcing.

Many concrete products plants today are making a "side line" of ornamental garden furniture including vases, benches, bird baths and sun dials. Where these are made of simple design with little or no ornamentation they are excellent for use in public parks, set so as to give the proper "accent" to a view, to lead the eye through a vista of trees or to break lines that would otherwise become monotonous. Products manufacturers usually dispose of such pieces through local department stores.

Copyright by Keystone View Co

Concrete tables and benches in a park in Santa Barbara, Calif. A good simple design, but the effect of so many in a group is monotonous

The picture shown here was taken in one of the parks in Santa Barbara, Calif., in the land where the use of concrete products has reached its highest development. There are many tables because picnicking is one of the pleasant customs of the country and there are times when there are none too many tables to accommodate all who desire to eat a meal in the fresh air. Other cities would do well to install such tables and benches.

Wisconsin Concrete Products Association Has Definite Program

THE Wisconsin Concrete Products Association has a reputation among the state associations of the country for its aggressive work in promoting the use of concrete products and for its progress in improving the technical methods of manufacturing these products. Much of its success, as its secretary, D. R. Collins writes in the letter given below, is due to the fact that it is always working to definite program for definite ends. A copy of a circular letter sent to all members of the association and the program for the present year follow:

Wisconsin Concrete Products Association,
March 3, 1925.

Much of the success of our Association can be attributed, I believe, to the fact that we have always worked on a very definite program. A copy of this year's program is attached. Read it over carefully. Perhaps you'll have some suggestions to make. But, above all, keep it in mind throughout the year and try to shape your efforts along the line of this program. If we all do this, it means a unified effort that is bound to bring success.

D. R. Collins,
Secretary-Treasurer.

Below are listed the various activities which the Wisconsin Concrete Products Association will stress during 1925.

1. PRODUCTION OF QUALITY PRODUCTS. To improve and maintain the quality of concrete products by a practical application of laboratory methods to plant operation. Not only is it intended to increase quality, but in so doing, reduce production cost.

2. MERCHANDISING AND ADVERTISING. To assist in every way practical a greater distribution of our products by the application of modern methods of merchandising and advertising.

3. LAW ENFORCEMENT. To work with proper officials, both state and local to see that proper legislation is enacted and enforced making possible the use of only quality products in masonry construction.

4. EDUCATION. To educate not only the building public, but our own members and employes, in the use of our product and in the various steps we have taken to control its quality.

5. FREIGHT RATES. To secure just and equitable freight rates that will allow fair competition with competitive materials and allow a greater expansion of our present markets.

6. PUBLICITY. To secure, wherever possible, proper publicity on the work of our association and its members through national and local publications.

7. HOME CONSTRUCTION. To, wherever possible, put our product in buildings "above the grade," particularly in the line of home construction.

8. LARGE BUILDING CONSTRUCTION. To work with architects, contractors and builders to include concrete products in specifications for factories, warehouses and public buildings.

9. INSURANCE RATES. To work with Fire Insurance Companies and Actuarial Bureaus, both through local and state agents to secure insurance rates on concrete masonry buildings in accord with the rating accorded this type of construction by the Underwriters' Laboratories.

10. AFFILIATION WITH NATIONAL. To affiliate with the Concrete Products Association (National) and participate in the work and benefits of that organization.

Detroit Company Builds New Cement Products Plant

A NEW plant for the manufacture of cement blocks and building tiles has been built by the Matz Building Products Corporation at 17260 Gable street, Detroit, Mich. This plant consists of a building 100 by 200 ft. and will turn out about 5000 cement blocks along with 3000 cement building tiles, size 5 by 8 by 12 in.

The president of the company, J. V. Matz, stated that a new interior building material which will be called "Matzite" will also be manufactured at the plant.

The company recently bought out the Matz Construction Co., of Detroit, according to the *Free Press* of that city, and is now equipped to do all kinds of excavating, masonry and cement work.

Concrete Best Material for the Dairy Manger

THE best material yet developed for dairy mangers is concrete, in the opinion of E. R. Gross, professor of rural engineering at the New Jersey State College of Agriculture. He states in the *Berlin (N. J.) Breeze*, that concrete enables one to maintain a high degree of sanitation and is durable, thus giving long service for the money invested.

He goes on to point out that concrete is almost universally accepted as the best material for dairy barn floors and that the shape, which is important in manger and floor construction, can be readily controlled in using concrete. The width and depth of the alley vary according to the size of the manger and there are four standard sizes, namely 20, 24, 28 and 32-in. width with 6, 12, 18 and 24-in. depth respectively.

Concrete Block by Poured Method

SIR: We think your warning on page 59 of the February 7 issue of ROCK PRODUCTS as to using just any old thing for making blocks is very timely. We had noted in some of your previous issues where certain firms were using waste material for block making. This we thought rather unusual and could not see why you did not call a halt to it at the time.

We are sending you an unsolicited inspection of our brick that was taken from our regular pile last fall. We make block the same way (poured concrete) and, by the way, we see very little comment on block-making by the poured concrete method. We notice our friend comments on the number of concrete block that should be made to a sack of cement on page 72, he says 27 to 28. We find it doing well when we get 15 to the sack; perhaps he is speaking of the tamp process. We have been using the poured concrete method for three years.

REPORT ON POURED CONCRETE BRICK

Chicago, Ill., February 9, 1925.—Concrete brick manufactured by the Ford Block Co., Ashland, Ky., were recently tested by the Structural Materials Research Laboratory here, and the results were highly satisfactory. Standard building codes require that concrete brick shall not absorb more than 12% of water by weight of the brick, and shall have a compression strength of not less than 1500 lb. per sq. in. These brick showed an absorption of 7.4% by weight and a compression strength of 4720 lb. per sq. in.—more than three times that required by standard building codes. If all building materials in Ashland were of such quality there would be little excuse for a building code.

(Signed) C. M. MOLSTAD,
Field Engineer.

In addition to making the smooth face block we make a block with glass, granite, and marble faces. We have a large sale on our block against the tamped block, and we get nearly double the price. It costs more to make our block, therefore, we are justified in receiving the high price.

We are now considering placing an additional mixer so as to color our concrete brick. The clay brick people are not doing much as they want $20 to $30 for their price, we have been selling our cement brick at $17; however we will increase the price to $20 when we start coloring them.

Respectfully yours,
FORD BLOCK CO., Ashland, Ky.

The Rock Products Market

Wholesale Prices of Crushed Stone

Prices given are per ton, F. O. B., at producing plant or nearest shipping point

Crushed Limestone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
EASTERN:						
Buffalo, N. Y.	a 1.30 per net ton all sizes					
Chaumont, N. Y.	1.00	.....	1.75	1.50	1.50	1.50
Eastern Pennsylvania	1.35	1.35	1.45	1.35	1.35	1.35
Munns, N. Y.	1.00	1.40	1.40	1.25	1.25	.....
Northern New Jersey	.....	.....	1.60	.....	.....	.....
Prospect, N. Y.	1.00	1.40	1.40	1.30	1.30	.....
Walford, Penn.	.....	.....	1.35	1.50	1.60	1.60
Watertown, N. Y.	.50	.....	1.75	1.50	1.50	1.50
Western New York	1.15	1.20	1.20	1.20	1.15	1.15
CENTRAL						
Alton, Ill.	1.75	.....	1.75	.....	.....	.....
Bloomville, Middlepoint, Dunkirk, Bellevue, Waterville, No. Baltimore, Holland, Kenton, New Paris, Ohio: Monroe, Mich.; Huntington, Bluffton, Ind.	1.00	1.10	1.10	1.00	1.00	1.00
Buffalo, Iowa	1.10	.....	1.45	1.25	1.30	1.30
Chicago, Ill.	.80	1.00	1.00	1.00	1.00	1.00
Columbia, Krause, Valmeyer, Ill.	1.15	1.20	1.20	1.20	1.10	1.10
Cypress, Ill.	1.20	1.20	1.15	1.20	1.25	1.25
Dundas, Ont.	.70	1.05	.90	.90	.90	.90
Greencastle, Ind.	1.30	1.25	1.05	1.05	.95	.95
Lannon, Wis.	.80	1.00	1.10	.90	.90	.90
Linwood, Iowa	1.00	1.25	1.25	1.05	1.05	1.15
Northern New Jersey	1.30	.....	1.80	1.60	1.40	.....
River Rouge, Mich.	1.00	1.00	1.00	1.00	1.00	1.10
St. Vincent de Paul, P. Q.	1.00	1.45	1.10	1.00	.95	.....
Stone City, Iowa	.75	.....	1.20†	1.10	1.05	.....
Toronto, Ont.	1.60	1.95	1.80	1.80	1.80	1.80
Waukesha, Wis.	.90	.90	.90	.90	.90	.90
Wisconsin Points	.50	1.00	.....	.90	.90	.....
Youngstown, Ohio	.....	.....	.....	1.50	1.60	1.60
SOUTHERN:						
Alderson, W. Va.	.60	1.60	1.60	1.50	1.40	.....
Bridgeport, Texas	1.00	1.00@1.35	1.35	1.25	1.25	1.10
Cartersville, Ga.	2.70	1.50	1.50	1.35	1.35	1.35
El Paso, Texas	1.00	1.00	1.00	1.00	1.00	.....
Ft. Springs, W. Va.	.60	1.60	1.60	1.50	1.40	.....
Graysville, Ga.	1.00	.....	.85@1.10	.85@1.00	.85@1.00	.....
WESTERN:						
Atchison, Kans.	.25	2.00	2.00	2.00	2.00	1.60‖@1.80
Blue Spr'gs & Wymore, Neb.	.20	1.45	1.45	1.35@1.40	1.25@1.30	1.20
Cape Girardeau Mo.	1.35	.....	1.25	1.25	1.00	.....
Kansas City, Mo.	1.00	1.65	1.65	1.65	1.65	1.65

Crushed Trap Rock

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Branford, Conn.	.60	1.70	1.45	1.20	1.05	.....
Duluth Minn.	1.00	2.25	2.00	1.75	1.35	1.35
Dwight, Calif.	1.75	1.75	1.75	1.75	1.75	.....
Eastern Maryland	1.00	1.60	1.60	1.50	1.35	1.35
Eastern Massachusetts	.85	1.75	1.75	1.25	1.25	1.25
Eastern New York	.75	1.25	1.25	1.25	1.25	1.25
Eastern Pennsylvania	1.15	1.60	1.60	1.50	1.35	1.35
Minneapolis, Minn.	1.25	.....	2.25	2.00	1.75	.....
New Haven, Wallingford and Britain, Conn.	.60	1.70	1.45	1.20	1.05	1.05
Northern New Jersey	1.50	2.00	1.80	1.40	1.40	.....
Oakland and El Cerrito, Calif.	1.75	1.75	1.75	1.75	1.75	.....
San Diego, Calif.	.50@ .75	1.80@1.90	1.60@1.80	1.35@1.55	1.35@1.55	1.25@1.45
Sheboygan, Wis.	1.00	1.10	1.10	1.10	1.10	.....
Springfield, N. J.	1.70	2.00	2.00	1.70	1.70	.....
Westfield, Mass.	.60	1.50	1.35	1.20	1.10	1.10

Miscellaneous Crushed Stone

City or shipping point	Screenings, ¼ inch down	½ inch and less	¾ inch and less	1½ inch and less	2½ inch and less	3 inch and larger
Berlin, Utley and Red Granite, Wis.—Granite	1.50	1.60	1.35	1.25	1.25	1.00
Coldwater, N. Y.—Dolomite			1.50 all sizes			
Columbia, S. C.—Granite	1.50b	.....	2.00	1.75	1.60	.....
Eastern Penn.—Sandstone	1.30	1.55	1.50	1.50	1.30	1.30
Eastern Penn.—Quartzite	1.20	1.35	1.25	1.20	1.20	1.20
Lithonia Ga.—Granite	.75(c)	1.75	1.66	1.25	1.25	.....
Lohrville, Wis.—Granite	1.65	1.70	1.65	1.45	1.50	.....
Middlebrook, Mo.—Granite	3.00@3.50	.....	2.00@2.25	2.00@2.25	.....	1.25@2.00
Northern New Jersey (Basalt)	150	2.00	1.80	1.40	1.40	.....
Richmond, Calif. (Basalt)	.75*	.....	1.50*	1.50*	1.50*	.....

*Cubic yd. †1 in. and less. ‖Rip rap per ton; (a) Deliveries after April 1. (b) Dust out. (c) Sand.

Agricultural Limestone
(Pulverized)

Alton, Ill. — Analysis, 98% $CaCO_3$; 90% thru 100 mesh	6.00
Asheville, N. C. — Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Branchton, Penn. — 100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Cape Girardeau, Mo.—Analysis, 93.5% $CaCO_3$, 3.5% $MgCO_3$; 90% thru 50 mesh	1.50
Cartersville, Ga. — Analysis, 68% $CaCO_3$, 32% $MgCO_3$; pulverized	2.50
90% thru 4 mesh	1.50
Chaumont, N. Y. — Pulverized limestone, bags, 4.00; bulk	2.50
Colton, Calif.—Analysis, 95% $CaCO_3$, 3% $MgCO_3$—all thru 20 mesh—bulk	4.00
Dundas, Ont., Can.—Analysis, 53.80% $CaCO_3$, 43.31% $MgCO_3$; 35% thru 100 mesh, 50% thru 50 mesh, 100% thru 10 mesh; bags, 4.75; bulk	3.00
Hillsville, Penn. — Analysis, 94% $CaCO_3$, 1.40% $MgCO_3$, 75% thru 100 mesh; sacks, $5.00; bulk	3.50
Jamesville, N. Y.—Analysis, 89.25% $CaCO_3$; 5.25% $MgCO_3$; pulverized, bags, 4.00; bulk	2.50
Knoxville, Tenn.—80% thru 100 mesh, bags, 3.95; bulk	2.70
Linville Falls, N. C.—Analysis, 57% $CaCO_3$, 39% $MgCO_3$; 50% thru 100 mesh; 200-lb. burlap bag, 4.00; bulk	2.75
Marblehead, Ohio — Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$; 60% thru 100 mesh; 70% thru 50 mesh; 100% thru 10 mesh; 80 lb. paper sacks, 5.10; bulk	3.60
Marion, Va. — Analysis, 90% $CaCO_3$, 2% $MgCO_3$; 42.5% thru 100 mesh, 11.3% thru 80, 20.2% thru 60, 22.8% thru 40, 3.2% thru 20 and under or 75% thru 40 mesh; pulverized, per ton	2.00
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 90% thru 100 mesh	3.90@ 4.50
Mountville, Va.—Analysis 76.60% $CaCO_3$, 22.83% $MgCO_3$; 50% thru 100 mesh, 100% thru 20 mesh—125-lb. hemp bags	5.00
Osborne, Penn.—100% thru 20 mesh; 60% thru 100 mesh; 45% thru 200 mesh. (Less 50 cents commission to dealers)	5.00
Piqua, Ohio—Total neutralizing power 95.3%; 99% thru 10, 60% thru 50; 50% thru 100	2.50@ 2.75
100% thru 10, 90% thru 50, 80% thru 100; bags, 5.10; bulk	3.60
99% thru 100, 85% thru 200; bags, 7.00; bulk	5.50
Watertown, N. Y.—Analysis, 96-99% $CaCO_3$; bags, 4.00; bulk	2.50
West Stockbridge and Rockdale, Mass., Danbury, Conn., North Powna, Vt. —Analysis, 90% $CaCO_3$, 5% $MgCO_3$; 50% thru 100 mesh; paper bags, 4.75; cloth, 5.25; bulk	3.25

Agricultural Limestone
(Crushed)

Alderson, W. Va. — Analysis, 90% $CaCO_3$; 90% thru 50 mesh	1.50
Alton, Ill.—Analysis 98% $CACO_3$; 50% thru 4 mesh	1.75
Bedford, Ind.—Analysis, 98½% $CaCO_3$, ½% $MgCO_3$; 90% thru 10 mesh	1.50
Bettendorf, Iowa — 97% $CaCO_3$, 2% $MgCO_3$; 50% thru 100 mesh; 50% thru 4 mesh	1.50
Blackwater, Mo.—77% $CaCO_3$; 100% thru 8 mesh, 25% thru 100 mesh	1.00
Bridgeport and Chico, Texas—Analysis, 94% $CaCO_3$, 2% $MgCO_3$; 100% thru 10 mesh	1.75
50% thru 4 mesh	1.50

(Continued on next page)

Agricultural Limestone

(Continued from preceding page)

Chicago, Ill.—50% thru 100 mesh; 90% thru 4 mesh ..... .80
Chico, Texas—100% thru 4 mesh..... 1.50
100% thru 10 mesh, bags, 5.00; bulk 2.00
Columbia, Krause, Valmeyer, Ill.—Analysis, 90% $CaCO_3$; 90% thru 4 mesh 1.15
Cypress, Ill.—50% thru 100 mesh..... 1.25
90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh 1.15
Ft. Springs, W. Va.—Analysis, 90% $CaCO_3$; 90% thru 50 mesh..... 1.50
Kansas City, Mo.—50% thru 100 mesh 1.25
Lannon, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 99% through 10 mesh; 46% through 60 mesh..... 2.00
Screenings (¼ in. to dust)..... 1.00
Marblehead, Ohio.—Analysis, 83.54% $CaCO_3$, 14.92% $MgCO_3$, 32% thru 100 mesh; 51% thru 50 mesh; 83% thru 10 mesh; 100% thru 4 mesh (meal) bulk 1.60
Mayville, Wis.—Analysis, 54% $CaCO_3$, 44% $MgCO_3$; 50% thru 50 mesh..... 1.85@ 2.35
Middlepoint, Bellevue, Kenton, Ohio; Monroe, Mich.; Huntington and Bluffton, Ind. — Analysis, 42% $CaCO_3$, 54% $MgCO_3$; meal, 25 to 45% thru 100 mesh..... 1.60
Milltown, Ind. — Analysis, 94.41% $CaCO_3$, 2.95% $MgCO_3$; 30.8% thru 100 mesh, 38% thru 50 mesh.... 1.45@ 1.60
Moline, Ill.—97% $CaCO_3$, 2% $MgCO_3$ —50% thru 100 mesh; 50% thru 4 mesh 1.50
Pixley, Mo.—Analysis, 96% $CACO_3$; 50% thru 50 mesh..... 1.25
50% thru 100 mesh; 90% thru 50 mesh; 50% thru 50 mesh; 90% thru 4 mesh; 50% thru 4 mesh..... 1.65
River Rouge, Mich.—Analysis, 54% $CaCO_3$, 40% $MgCO_3$; bulk..... .80@ 1.40
Stone City, Iowa. — Analysis, 98% $CaCO_3$; 50% thru 50 mesh..... .75
Waukesha, Wis.—Test, 107.38% bone dry, 100% thru 10 mesh; bags, 2.85; bulk 2.10

Pulverized Limestone for Coal Operators

Hillsville, Penn., sacks, 4.50; bulk..... 3.00
Piqua, Ohio, sacks, 4.50@5.00 bulk .. 3.00@ 3.50
Waukesha, Wis.—Bulk 4.00

Miscellaneous Sands

Silica sand is quoted washed, dried and screened unless otherwise stated. Prices per ton.

Glass Sand:
Berkeley Springs, W. Va..... 2.00@ 2.25
Cedarville and S. Vineland, N. J.—
Damp 1.75
Dry 2.25
Cheshire, Mass:
6.00 to 7.00 per ton; bbl..... 2.50
Columbus, Ohio ..... 1.25@ 1.50
Estill Springs and Sewanee, Tenn..... 1.50
Grays Summit and Klondike, Mo..... 2.00
Los Angeles, Calif.—Washed..... 5.00
Mapleton Depot, Penn..... 2.00@ 2.25
Massillon, Ohio 3.00
Ohlton, Ohio 2.50
Ottawa, Ill.—Chemical and mesh guaranteed 1.50
At market 1.00
Pacific, Mo. ..... 2.25@ 3.00
Pittsburgh, Penn.—Dry 4.00
Damp 3.00
Red Wing, Minn.:
Bank run 1.50
Ridgway, Penn. 2.50
Rockwood, Mich. ..... 2.75@ 3.25
Round Top, Md. 2.25
San Francisco, Calif..... 4.00@ 5.00
St. Louis, Mo..... 2.00
Sewanee, Tenn. 1.50
Thayers, Penn. 2.50
Zanesville, Ohio 2.50

Miscellaneous Sands:
Aetna, Ind.:
Core, Box cars, net, .35; open-top cars ..... .30
Albany, N. Y.:
Core 1.50
Molding fine, brass molding..... 2.25
Molding coarse 2.00
Sand blast 3.50
Arenzville and Tamalco, Ill.:
Core 1.00
Molding coarse 1.50
Molding fine ..... 1.50@ 1.75
Brass molding 2.00
Beach City, Ohio:
Fine core..... 1.75
Furnace bottom..... 2.50

(Continued on next page)

Wholesale Prices of Sand and Gravel

Prices given are per ton, f. o. b. producing plant or nearest shipping point

Washed Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel, ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
EASTERN:						
Ambridge & So. H'g'ts, Penn.	1.25	1.25	1.15	.85	.85	.85
Buffalo, N. Y.	1.10	.95	.85	.....	.....	.....
Erie, Penn.	.....	1.00	.....	1.10	1.25	.....
Farmingdale, N. J.	.58	.48	1.05	1.20	1.10	.....
Leeds Jct., Maine	.....	.50	1.75	.....	1.35	1.25
Machias Jct., N. Y.	.....	.75	.75	.75	.75	.75
Montoursville, Penn.	1.00	1.10	1.25	1.00	.90	.80
Northern New Jersey	.....	.40@ .80	1.25	1.50	1.50	.....
Olean, N. Y.	.....	.90	.75	.75	.75	.75
Pittsburgh, Penn., and vicinity	1.25	1.25	1.05	1.05	.85	.85
Shining Point, Penn.	.....	.....	1.00	1.00	1.00	1.00
Washington, D. C.—Rewashed, river	.85	.85	1.70	1.50	1.30	1.30
CENTRAL:						
Attica, Ind.	.75	.75	.75	.75	.75	.75
Barton, Wis.	.....	.60	.80	.80	.80	.....
Columbus, Ohio	.75	.75@1.00	.75	.75@1.00	.75@1.00	.75@1.00
Covington, Ind.	.75	.75	.75	.75	.75	.75
Des Moines, Iowa	.50	.30	1.50	1.50	1.50	1.50
Eau Claire, Wis.	.....	.40	.85@1.25	.....	.85	.....
Elkhart Lake, Wis.	.65	.60	.62	.62	.62	.62
Ft. Dodge, Iowa	.....	2.05	2.05	2.05	2.05	2.05
Ft. Worth, Texas	2.00	2.00	2.00	2.00	2.00	2.00
Grand Rapids, Mich.	.....	.50	.....	.80	.70	.70
Hamilton, Ohio	.....	1.00	.....	.....	1.00	.....
Hersey, Mich.	.....	.50	.....	.80	.....	.70
Indianapolis, Ind.	.60	.60	.....	.90	.75@1.00	.75@1.00
Janesville, Wis.	.....	.65@ .75	.....	.....	.65@ .75	.....
Mason City, Iowa	.45@ .55	.45@ .55	1.35@1.45	1.45@1.55	1.40@1.50	1.35@1.45
Mankato, Minn.	.....	.40	1.25a	.....	1.25	.....
Milwaukee, Wis.	.....	1.01	1.21	1.21	1.21	1.21
Minneapolis, Minn.*	.35	.35	1.35	1.25	1.25	1.25
Northern New Jersey	.45@ .50	.45@ .50	.....	1.25	1.25	.....
Palestine, Ill.	.75	.75	.75	.75	.75	.75
St. Louis, Mo., f. o. b. cars	1.18	1.45	1.65‖	1.45	.....	1.45‖
Silverwood, Ind.	.75	.75	.75	.75	.75	.75
Summit Grove, Ind.	.75	.75	.75	.75	.75	.75
Terre Haute, Ind.	.75	.60	.90	.90	.90	.85
Wolcottville, Ind.	.75	.75	.75	.75	.75	.75
Waukesha, Wis.	.....	.45	.55	.60	.65	.65
Winona, Minn.	.40	.40	1.25	1.10	1.00	1.00
Yorkville, Sheridan, Oregon, Moronts, Ill.			Average .40@.60			
Zanesville, Ohio	.70	.60	.....	.60	.90	.90
SOUTHERN:						
Brookhaven, Miss., Roseland La.	1.75*	.70	2.25	1.50	1.25	.....
Charleston, W. Va.	All sand 1.40 f.o.b. cars.			All gravel 1.50 f.o.b. cars.		
Chehaw, Ala.	00@ .30	.....	.40	.50	.....	.....
Estill Sp'gs & Sewanee, Tenn.	1.00	.90	1.00	1.00	.85	.85
Knoxville, Tenn.	1.00	1.00	1.20	1.20	1.20	1.20
Macon and Gaillaro, Ga.	.50	.50	.....	.60	.65	.65
New Martinsville, W. Va.	.90	.90	.....	.....	.....	.90
Roseland, La.	.60	.50	2.25	1.25	1.25	1.50
Smithville, Texas	.....	.90	.90	.90	.90	.75
WESTERN:						
Baldwin Park, Calif.	.....	.25@ .35	.....	.....	.50@ .75	.....
Crushed rock	.90@1.10	.60@ .90	.60@ .90	.60@ .90	.60@ .90	.....
Kansas City, Mo.	.80	.70	.....	.....	.....	.....
Los Angeles, Calif.	.....	.40	.50	.65	.60	.60
Pueblo, Colo.	1.10*	.90*	.....	1.60*	.....	1.50*
San Diego, Calif.	.50	.50	1.20	1.20	1.00	1.00
Seattle, Wash. (bunkers)	1.50*	1.50*	1.50*	1.50*	1.50*	1.50*

Bank Run Sand and Gravel

City or shipping point	Fine Sand, 1/10 in. down	Sand, ¼ in. and less	Gravel ½ in. and less	Gravel, 1 in. and less	Gravel, 1½ in. and less	Gravel, 2 in. and less
Boonville, N. Y.	.60@ .80	.....	.55@ .75	.....	.....	1.00
Brookhaven, Miss., Rosel'd, La.	Road gravel, ballast gravel .60 a ton					
Chehaw, Ala.	00@ .30	.....	.....	.....	.....	.....
Des Moines, Iowa	Washed, .50; unwashed, .40 (not screened)					
Dudley, Ky.	1.15	1.15	.....	.95	.....	.....
East Hartford, Conn.	Sand, .65 per cu. yd.					
Elkhart Lake, Wis.	.50	.....	.....	.....	.....	.....
Gainesville, Texas	.....	.95	.....	.....	.....	.5[illegible]
Grand Rapids, Mich.	.....	.....	.....	.60	.....	.....
Hamilton, Ohio	.....	.....	.....	.....	.70	.....
Hersey, Mich.	.....	.....	.....	.55	.....	.....
Indianapolis, Ind.	Mixed gravel for concrete work, .65					
Lindsay, Texas	.....	.....	.....	.....	.....	.55
Macon and Gaillaro, Ga.	.....	.35	.....	.....	.....	.....
Mankato, Minn.	Pit run gravel, .50					
Moline, Ill. (b)	.60	.60	Concrete gravel, 50% G., 50% S., 1.00			
Montezuma, Ind.	.....	.....	.....	.....	.....	.60
St. Louis, Mo.	Mine run gravel 1.55 per ton					
Shining Point, Penn.	Concrete sand, 1.10 ton					
Smithville, Texas	.50	.50	.50	.50	.50	.50
Summit Grove, Ind.	.50	.50	.50	.50	.50	.50
Waukesha, Wis.	.60	.60	.60	.60	.60	.60
Winona, Minn.	.60	.60	.60	.60	.60	.60
York, Penn.	1.10	.....	.....	.....	.....	.....
Zanesville, Ohio	.....	.60	.....	.....	.....	.....

*Cubic yd.; (a) ¾ in. and less; (b) river run.

Miscellaneous Sands

(Continued from preceding page)

Molding fine and coarse		2.00
Traction unwashed and screened		1.75
Cheshire, Mass.—Furnace lining, molding fine and coarse		5.00
Sand blast	5.00@	8.00
Stone sawing		6.00
Columbus, Ohio:		
Core	.30@	.50
Furnace lining, molding coarse	2.00@	2.25
Molding fine	2.50@	2.75
Sand blast	4.00@	4.50
Stone sawing		1.50
Traction	.50@	.75
Brass molding	2.50@	3.00
Dresden, Ohio:		
Core	1.25@	1.50
Molding fine	1.50@	1.75
Molding coarse		1.50
Traction		1.25
Brass molding		1.75
Dunbar, Penn.:		
Traction (damp)		2.00
Eau Claire, Wis.:		
Sand blast	3.00@	3.25
Roofing sand		4.25
Traction	.40@	.65
Elco, Ill.:		
Ground silica per ton in carloads	22.00@	31.00
Estill Springs and Sewanee, Tenn:		
Molding fine and core		1.25
Roofing sand, sand blast, traction	1.35@	1.50
Franklin, Penn.:		
Core		2.00
Molding coarse and fine		1.75
Grays Summit and Klondike, Mo.:		
Molding fine, core and stone sawing	1.75@	2.00
Joliet, Ill.:		
No. 2 molding sand; also loam for luting purposes and open-hearth work	.65@	.85
Klondike, Mo.:		
Molding fine	1.75@	2.00
Mapleton Depot, Penn.:		
Molding fine, traction and blast		2.00
Roofing sand		2.25
Massillon, Ohio:		
Molding fine, coarse, furnace lining core and traction		2.50
Michigan City, Ind.:		
Core and traction	.30@	.40
Montoursville, Penn.:		
Core	1.35@	1.50
Traction	1.00@	1.10
New Lexington, Ohio:		
Molding fine		2.50
Molding coarse		2.25
Ohlton, Ohio:		
Core and sand blast, both green		2.00
Roofing sand, furnace lining, molding fine and coarse, stone sawing, traction, all green		1.75
Add 50c a ton for green sand dried.		
Oceanside, Calif.:		
Roofing sand (stucco)	3.00@	3.40
Ottawa, Ill.:		
Crude silica sand	1.00@	1.25
Core, furnace lining		1.25
Roofing sand, brass molding	1.25@	2.50
Sand blast, stone sawing		4.00
Traction		1.00
Pacific, Mo.:		
Core, furnace lining	1.00@	1.25
Molding fine	.90@	1.00
Stone sawing	1.00@	1.75
Molding coarse	.85@	1.00
Red Wing, Minn.:		
Core, furnace lining, stone sawing		1.50
Molding fine and coarse, traction		1.25
Sand blast		3.50
Filter sand		3.75
Ridgway, Penn.:		
Core		2.00
Furnace lining, molding fine, molding coarse		1.25
Traction		2.25
Round Top, Md.:		
Core		1.60
Traction, damp		1.75
Roofing and blast sand		2.25
St. Louis, Mo.:		
Core	1.00@	1.75
Furnace lining		1.50
Molding fine	1.50@	2.50

Crushed Slag

City or shipping point	Roofing	¼ in. down	⅜ in. and less	¾ in. and less	1½ in. and less	2½ in. and less	3 in. and larger
EASTERN:							
Buffalo, N. Y.	2.25@2.35	1.25@1.35	1.25@1.35	1.25@1.35	1.25@1.35	1.25@1.35	1.25@1.35
E. Canaan, Conn.	3.00	1.00	2.25	1.25	1.25	1.15	1.15
Eastern Penn. and Northern N. J.	2.50	1.20	1.50	1.20	1.20	1.20	1.20
Reading, Pa.	2.50	1.00	.....	1.25	.....	.....	.....
Western Penn.	2.50	1.25	1.50	1.25	1.25	1.25	1.25
CENTRAL:							
Ironton, Ohio	2.05	1.45	1.65	1.45	.....	1.45	.....
Jackson, Ohio	.....	1.05	.....	1.30	1.05	1.30	1.30
Toledo, Ohio	1.50	1.25	1.25	1.25	1.25	1.25	1.25
Youngst'n, O., dist.	2.00	1.25	1.35	1.35	1.25	1.25	1.25
SOUTHERN:							
Ashland, Ky.	2.25	1.55	.....	1.55	1.55	1.55	.....
Ensley and Alabama City, Ala.	2.05	.80	1.25	1.15	.90	.90	.80
Longdale, Roanoke, Ruesens, Va.	2.50	1.00	1.25	1.25	1.25	1.15	1.15

Lime Products (Carload Prices Per Ton F.O.B. Shipping Point)

	Finishing hydrate	Masons' hydrate	Agricultural hydrate	Chemical hydrate	Ground burnt lime, Blk.	Ground burnt lime, Bags	Lump lime, Blk.	Lump lime, Bbl.
EASTERN:								
Berkeley, R. I.	.....	.....	12.00	.....	.....	.....	.....	2.20
Buffalo, N. Y.	.....	10.00	9.00	12.00	.....	.....	.....	.....
Lime Ridge, Penn.	.....	.....	.....	.....	.....	.....	5.00a	.....
West Stockbridge, Mass.	.....	10.50	5.60	.....	.....	.....	.....	2.25m
Williamsport, Penn.	.....	.....	10.00	.....	.....	.....	6.00	.....
York, Penn.	.....	10.50	10.50	11.50	.....	.....	8.50	1.65i
CENTRAL:								
Cold Springs, Ohio	.....	10.00	9.00	.....	9.00	11.00	9.00	.....
Delaware, Ohio	12.50	10.00	9.00	10.50	.....	.....	9.00	1.50
Gibsonburg, Ohio	12.50	.....	.....	.....	9.00	11.00	9.00	.....
Huntington, Ind.	12.50	10.00	9.00	.....	9.00	11.00	9.00	.....
Luckey, Ohio (f)	12.50	.....	.....	.....	.....	.....	.....	.....
Marblehead, Ohio	.....	10.00	9.00	12.00	.....	.....	9.00	1.50c
Marion, Ohio	.....	10.00	9.00	.....	.....	.....	9.00	1.50c
Mitchell, Ind.	.....	12.00	12.00	12.00	11.00	.....	10.00	1.70e
Sheboygan, Wis.	.....	.....	.....	.....	.....	.....	9.50	.....
Tiffin, Ohio	.....	10.00	.....	.....	.....	.....	.....	.....
White Rock, Ohio	12.50	.....	.....	.....	9.00	11.00	9.00	1.50c
Woodville, Ohio	12.50f	10.00f	9.00f	.....	9.00	10.50f	9.00	1.50f
SOUTHERN:								
Erin, Tenn.	.....	.....	.....	.....	.....	.....	7.80	1.25
El Paso, Texas	.....	.....	.....	.....	.....	.....	9.00	2.00
Graystone & Wilmay, Ala.	12.50	11.00	.....	8.50	.....	.....	8.50	1.50
Karo, Va.	.....	10.00	9.00	.....	.....	.....	7.00g	1.65h
Knoxville, Tenn.	20.00	11.00	.....	11.00	.....	1.35	8.50	1.50
Varnons, Ala. (f)	.....	10.00p	10.00p	.....	.....	.....	8.00q	1.40r
Zuber and Ocala, Fla.	14.00	12.00	10.00	.....	.....	.....	12.00	1.70
WESTERN:								
Kirtland, N. M.	.....	.....	.....	.....	.....	.....	15.00	.....
San Francisco, Calif.	20.00†	20.00†	15.00s	20.00†	.....	.....	.....	2.50o
Tehachapi, Calif.	.....	.....	.....	.....	.....	.....	16.20	.....

†50-lb. paper bags; (a) run of kilns; (c) wooden, steel 1.70; (d) wood; (e) wood bbl., $2.20 drum in steel; (f) dealers' prices; (g) to 9.50; (h) to 1.75; (i) 200 lb. bbl.; 2.65, 300 lb. bbl.; (l) bags; (m) finishing lime, 3.00 common; (n) common lime; (o) high calcium; (p) to 11.00; (q) to 8.50; (r) to 1.50; (s) in 125-lb. burlap sacks.

Miscellaneous Sands

(Continued)

Molding coarse	1.25@	1.75
Roofing sand		1.75
Sand blast	3.50@	4.50
Stone sawing	1.25@	2.25
Traction		1.25
Brass molding	2.00@	3.00
San Francisco, Calif:		
(Washed and dried) — Core, sand blast and brass molding	3.50@	5.00
Furnace lining and roofing sand	3.50@	4.50
Molding fine and traction		3.50
Molding coarse		4.50
(Direct from pit)—Core and molding fine	2.50@	4.50
Sewanee, Tenn.:		
Molding fine and coarse, roofing sand, sand blast, stone sawing, traction, brass molding		1.25
Tamms, Ill.:		
Ground silica per ton in carloads	20.00@	31.00
Thayers, Penn.:		
Core		2.00
Molding fine and coarse		1.25
Traction		2.25
Utica, Ill.:		
Furnace lining	.75@	1.00
Molding fine		.75
Molding coarse		.85
Utica, Penn.:		
Core		2.00
Molding fine and coarse		1.75
Warwick, Ohio.:		
Core, molding coarse (green) 2.00; (dry) 2.50; traction		2.50
Zanesville, Ohio:		
Molding coarse	1.50@	1.75
Molding fine, brass molding	1.75@	2.00

Talc

Prices given are per ton f.o.b. (in carload lots only), producing plant, or nearest shipping point.

Baltimore, Md.:		
Crude talc (mine run)	3.00@	4.00
Ground talc (20-50 mesh), bags		10.00
Cubes		55.00
Blanks (per lb.)		.08
Pencils and steel workers' crayons, per gross		1.25
Chatsworth, Ga.:		
Crude (for grinding)		4.00
Ground (25-50 mesh) 200 lb. bags		6.00
Ground (150-200 mesh) 200 lb. bags		10.00
Chester, Vt.:		
Ground (150-200 mesh) (Bags extra, returnable)	10.00@	10.50
Chicago, Ill.:		
Ground (150-200 mesh) bags		30.00
E. Granville, Rochester, Johnson, Waterbury, Vt.:		
Ground talc (20-50 mesh) bags	7.00@	10.00
Ground talc (150-200 mesh) bags	10.00@	25.00
Pencils and steel workers' crayons, per gross	.75@	2.00
Emeryville, N. Y.:		
(Double air floated) including bags; 325 mesh (50 lb. paper, 100 & 200 lb. burlap bags)		14.75
Hailesboro, N. Y.:		
Ground (150-200 mesh) bags		18.00
Ground (200-300 mesh) bags		20.00
Henry, Va.:		
Crude talc (mine run) per 2000-lb. ton	2.75@	3.50
Ground (150-200 mesh), bags	9.00@	14.00
Joliet, Ill.		
Ground (200 mesh), bags		30.00
Marshall, N. C.:		
Crude	4.00@	8.00
Ground (20-50 mesh), bags extra	6.50@	8.50
Ground (150-200 mesh), bags	8.00@	12.00
Natural Bridge, N. Y.:		
Ground talc (300-325 mesh), bags		13.00

Rock Phosphate

Prices given are per ton (2240-lb.) f.o.b. producing plant or nearest shipping point.

Lump Rock

Gordonsburg, Tenn.—B.P.L. 68-72%	4.00@	5.00
Mt. Pleasant, Tenn.—B.P.L. 75-78%	6.50@	8.00
75% hand mined		6.50
75% (free of fines for furnace use)		6.75
75% max. 5½% I and A	6.50@	7.00
78% max. 4½% I and A		8.00
72% B.P.L.	5.50@	6.00
Tennessee—F. O. B. mines, gross ton, unground Tenn. brown rock, 72% min. B.P.L.		5.50
Twomey, Tenn.—B.P.L. 65%, 2000 lb.	7.00@	8.00

Ground Rock

(2000 lb.)

Centerville, Tenn.—B.P.L. 65%		7.00
Gordonsburg, Tenn.—B.P.L. 68-72%	4.00@	5.00
Mt. Pleasant, Tenn. — B.P.L. 65% 95% thru 100 mesh		7.00
B.P.L. 13%. 95% thru 80 mesh		5.75
Twomey, Tenn.—B.P.L., 65%	7.00@	8.00

(Continued on next page)

Roofing Slate

The following prices are per square (100 sq. ft.) for Pennsylvania Blue-Clay Roofing Slate, f. o. b. cars quarries:

Sizes	Genuine Bangor, Washington Big Bed, Franklin Big Bed	Genuine Albion	Slatington Small Bed	Genuine Bangor Ribbon
24x12, 24x14	10.20	10.00	8.10	7.80
22x12	10.80	10.00	8.40	8.75
22x11	10.80	10.50	8.40	8.75
20x12	12.60	10.50	8.70	8.75
20x10, 18x10, 18x9, 18x12	12.60	11.00	8.70	8.75
16x10, 16x9, 16x8, 16x12	12.60	11.00	8.40	8.75
14x10	11.10	11.00	8.10	7.80
14x8	11.10	10.50	8.10	7.80
14x7 to 12x6	9.30	10.50	7.50	7.80
	Mediums	Mediums	Mediums	Mediums
24x12	$ 8.10	$8.10	$7.20	$5.75
22x11	8.40	8.40	7.50	5.75
Other sizes	8.70	8.70	7.80	5.75

For less than carload lots of 20 squares or under, 10% additional charge will be made.

(Continued from preceding page)

Florida Phosphate

(Raw Land Pebble)

Per Ton

Florida—F. O. B. mines, gross ton, 68/66% B.P.L., Basis 68%	2.25
70% min. B.P.L., Basis 70%	2.50
72% min. B.P.L., Basis 72%	2.75
75/74% B.P.L., Basis 75%	3.75

Fluorspar

Fluorspar—80% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	20.00
Fluorspar—85% and over calcium fluoride, not over 5% silica; per ton f.o.b. Illinois and Kentucky mines	21.00
Fluorspar, foreign, 85% calcium fluoride, not over 5% silica, c.i.f. Philadelphia, duty paid, per gross ton	18.00

Special Aggregates

Prices are per ton f. o. b. quarry or nearest shipping point.

City or shipping point	Terrazzo	Stucco chips
Barton, Wis., f.o.b. cars		10.50
Brandon, Vt.—American Botticino	9.00‡	9.00‡
Coral pink	9.00‡	9.00‡
Chicago, Ill.—Stucco chips, in sacks f.o.b. quarries		17.50
Crown Point, N. Y.—Mica Spar		8.00@10.00
Easton, Penn., and Phillipsburg, N. J.—Slate granules		6.00@ 6.50
Royal and creme green		15.00
Evergreen		10.00
Haddam, Conn. — Felstone buff	15.00	15.00
Harrisonburg, Va.—Blk marble (crushed, in bags	†12.50	†12.50
Ingomar, Ohio (in bags)		5.00@22.00
Middlebrook, Mo.—Red		20.00@25.00
Milwaukee, Wis.		14.00@34.00
Newark, N. J.—Roofing granules		7.50
New York, N. Y.—Red and yellow Verona		32.00
Poultney, Vt.		6.12
Red Granite, Wis.		7.50
Sioux Falls, S. D.	7.50	7.50
Stockton, Cal.—CL lots		12.00
Tuckahoe, N. Y.		12.00
Villa Grove, Colo.		13.00
Wauwatosa, Wis.		16.00@45.00

†C.L. Less than C. L., 15.50.
‡Plus 2.00 per ton for bags.

Concrete Brick

Prices given per 1000 brick, f.o.b. plant or nearest shipping point.

	Common	Face
Appleton, Minn.	22.00	25.00@35.00
Baltimore, Md. (Del. according to quantity)	16.00@16.50	22.00@50.00
Ensley, Ala. ("Slagtex")	12.50	22.50@33.50
Eugene, Ore.	25.00	35.00@75.00
Friesland, Wis.	22.00	32.00
Milwaukee, Wis.	14.00	30.00@42.00
Omaha, Neb.	18.00	30.00@40.00
Philadelphia, Penn.	15.00	21.00
Portland, Ore.	19.00	25.00@45.00
Prairie Du Chien, Wis.	14.00	25.00@33.00
Puyallup, Wash.	20.00	30.00@90.00
Rapid City, S. D.	18.00	25.00@45.00
Salem, Ore.	23.00	90.00@100.00
Watertown, N. Y.	18.00@21.00	35.00@37.50
Wauwatosa, Wis.	14.00@18.00	30.00@42.00

Sand-Lime Brick

Prices given per 1000 brick f. o. b. plant or nearest shipping point, unless otherwise noted.

Barton, Wis.	10.50
Boston, Mass.	14.00@15.50
Brighton, N. Y.	16.75
Dayton, Ohio	12.50@13.50
Grand Rapids, Mich. (wholesale)	10.00
Jackson, Mich.	13.00
Lancaster, N. Y.	13.00
Michigan City, Ind.	11.00
Milwaukee, Wis.	13.00
Plant City, Fla.	11.00@15.00
Portage, Wis.	15.00
Saginaw, Mich.	13.00
San Antonio, Texas	13.00@13.50
Syracuse, N. Y.	16.00@18.00
Wilkinson, Fla. (white and buff)	11.00@16.00

Gray Klinker Brick

El Paso, Texas	13.00

Lime

Warehouse prices, carload lots at principal cities.

	Hydrated, per ton Finishing	Common
Atlanta, Ga.	22.50	14.00
Baltimore, Md.	24.25	17.85
Boston, Mass.	20.00	15.00
Cincinnati, Ohio	16.80	14.30
Chicago, Ill.	20.00	.....
Dallas, Tex.	20.00	.....
Denver, Colo.	24.00	.....
Detroit, Mich.	16.00	.....
Minneapolis, Minn. (white)	23.00	21.00
Montreal, Que.	.....	21.00
New York, N. Y.	18.20	12.00@13.10
Philadelphia, Penn.	23.00	16.00
St. Louis, Mo.	24.00	20.00
San Francisco, Calif.	22.00	.....
Seattle, Wash. (paper sacks)	24.00	.....

Portland Cement

Prices per bag and per bbl. without bags net in carload lots.

	Per Bag	Per Bbl.
Albany, N. Y.	.....	2.62
Atlanta, Ga.	.....	2.35
Boston, Mass.	.63	2.53@2.63
Buffalo, N. Y.	.60	2.38@2.48†
Cedar Rapids, Iowa	.....	2.44
Cincinnati, Ohio	.....	2.47
Cleveland, Ohio	.....	2.39
Chicago, Ill.	.....	2.20
Columbus, Ohio	.....	2.44
Dallas, Texas	.53¾	2.15
Davenport, Iowa	.....	2.39
Dayton, Ohio	.....	2.48
Denver, Colo.	.63¾	2.55
Detroit, Mich.	.....	2.25§
Duluth, Minn.	.....	2.19
Indianapolis, Ind.	.....	2.41
Kansas City, Mo.	.51¾	2.07
Los Angeles, Cal. (less 5c dis.)	.60	2.60
Memphis, Tenn.	.....	2.60
Milwaukee, Wis.	.....	2.25@2.35§
Minneapolis, Minn.	.....	2.42
Montreal, Canada (sks. 20c ext.)	.....	1.90a
New Orleans, La.	.....	2.40
New York, N. Y.	.54	2.25†
Peoria, Ill.	.....	2.37
Philadelphia, Penn.	.58	2.31@2.41
Phoenix, Ariz.	.82½	3.65
Pittsburgh, Penn.	.....	2.19
Portland, Ore.	.....	3.05
San Francisco, Calif.	.65¼	2.71*
St. Louis, Mo.	.57½	2.30
St. Paul, Minn.	.....	2.42
Seattle, Wash. (10c bbl. dis.)	.....	2.65
Toledo, Ohio	.....	2.40

NOTE—Add 40c per bbl. for bags.
*Including sacks at 10c each.
§Less 10c 10 days.
†Prices to contractors, including bags.
(a) Less 10c 20 days.

Mill prices f.o.b. in carload lots, without bags, to contractors.

	Per Bag	Per Bbl.
Buffington, Ind.	.....	1.95
Concrete, Wash.	.....	2.60
Dallas, Texas	.....	2.50
Fordwick, Va.	.....	2.05
Hannibal, Mo.	.....	2.05
Hudson, N. Y.	.....	2.05
Kingsport, Tenn.	.....	2.05
Leeds, Ala.	.....	1.95
Louisville, Ky.	.64¾	2.45
Nazareth, Penn.	.....	1.95
Northampton, Penn.	.....	1.95
Seattle, Wash.	.....	2.35
Steelton, Minn.	.....	2.00
Universal, Penn.	.....	1.95

Cement Products

Hawthorne tile, carload lots, f. o. b. plant.

	Cicero, Ill. Per sq.	Ft. Worth, Tex. Per sq.
Silver gray	.....	8.00
Red French	9.50	9.00
Green French	11.50	10.00
Red Spanish	10.00	9.00
Green Spanish	12.00	10.00

	—Cicero— Red	Green	—Ft. Worth— Gray	Red	Green
Ridges	.25	.35	.25	.25	.30
Hips	.20	.30	.14	.14	.17
Ridge closers	.05	.06	.06	.06	.06
Hip terminals, 3 way	1.25	1.50	1.00	1.00	1.25
Hip starters	.50	.60	.22	.22	.25
Gable finials	1.25	1.50	1.00	1.00	1.25
Gable starters	.20	.30	.14	.14	.16
End bands	.20	.30	—	—	—
Eave closers	.06	.08	.06	.06	.06

Gypsum Products—CARLOAD PRICES PER TON AND PER M SQUARE FEET, F. O. B. MILL

	Crushed Rock	Ground Gypsum	Agricultural Gypsum	Stucco Calcined Gypsum	Cement and Gauging Plaster	Wood Fiber	White Gauging	Sanded Plaster	Keene's Cement	Trowel Finish	—Plaster Board— ¼x32x36" Weight 1500 lb. Per M Sq. Ft.	⅜x32x36" Weight 1850 lb. Per M Sq. Ft.	Wallboard. ⅜x32 or 48" Lengths 6'-10', 1850 lb. Per M Sq. Ft.
Agatite, Texas (a)	.....	.....	6.00	10.00	10.00	10.50	10.00	.....	19.00	.....	.....	.....	.....
Akron, N. Y. (a)	3.00	4.00	6.00	10.00	10.00	10.00	20.20	7.00@9.00	27.35	21.00	19.375	20.00	30.00@32.00
Blue Rapids, Kans. (a)	2.50	4.00	6.00	10.00	10.00	10.50	10.00	.....	23.15	19.00	19.375	20.00	.....
Douglas, Ariz.	.....	.....	7.00	.....	16.50	.....	19.50	.....	.....	15.50	.....	.....	.....
Ft. Dodge, Iowa (a)	2.50	4.00	6.00	10.00	10.00	10.50	15.45	.....	22.70	20.00	19.375	20.00	30.00
Grand Rapids, Mich.	2.50*	.....	6.00	9.00	9.00‡	9.00†	.....	.....	.....	.....	.....	.....	.....
Gypsum, Ohio (a)	2.75	4.00	6.00	10.00	10.00	10.00	19.25	7.50	26.85	19.00	19.375	20.00	30.00
Hanover, Mont.	.....	.....	.....	11.80	.....	.....	.....	.....	.....	.....	.....	.....	.....
Port Clinton, Ohio	3.00	4.00	6.00	8.00	9.00	9.00	21.00	7.00	30.15	20.00	.....	20.00	30.00
Portland, Colo.	.....	.....	.....	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....
San Francisco, Calif.	.....	.....	9.85	.....	14.40	.....	15.40	.....	.....	.....	.....	.....	.....
Winnipeg, Man.	5.50	5.50	7.00	13.50	15.00	15.00	.....	.....	.....	.....	28.50	.....	34.00

NOTE—Returnable Bags, 10c each; Paper Bags, 1.00 per ton extra (not returnable).
*To 3.00; †to 11.00; ‡to 12.00.

New Machinery and Equipment

A New "Gyrating" Screen

A NEW type of shaker screen, first exhibited at the National Crushed Stone Association convention at Cincinnati, Ohio, last January, is now being marketed by the Orville-Simpson Co., Cincinnati, Ohio. The new screen is an improvement of the well known "Rotex" screen, based on extensive experience with the use of this screen in the rock products industries.

The gyratory motion at the head end of the screen, it is claimed, moves the material sideways as much as endways insuring good distribution across the screen, even when fed from one side; also, it has a better stratifying effect, causing the fine material to quickly sink down against the screen, while the coarse material rides off the top.

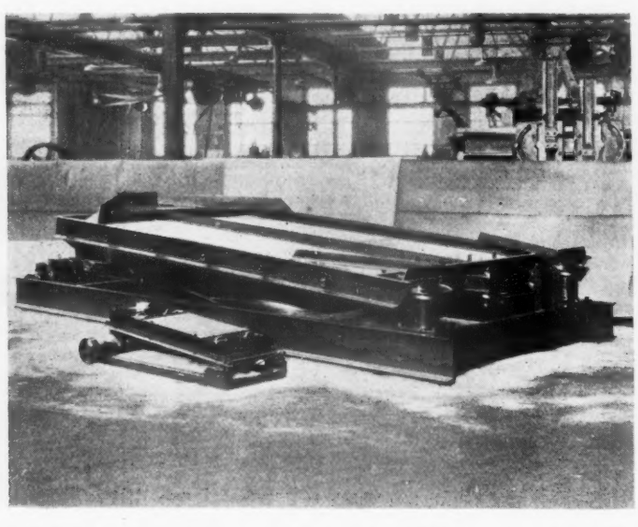
The "jumbo-screen" is an 8 ft. by 12 ft. For average purposes it is equipped with a 4-mesh screen cloth, and with this equipment is claimed to make a clean separation of crushed limestone which has previously passed a ¾-in. screen while fed at the rate of ¾ tons per hour per square foot of screen cloth, passing one-third over and two-thirds through the screen. At this rate a screen with two 4x12 screening surfaces receives a total feed of 72 tons per hour on this class of work. The capacity under various working conditions, of course, depends on the nature of the material, percentage of various sizes, moisture content, etc. The range of sizes screened is from ¾-in. to the finest meshes in ordinary practice.

The motive power required to operate the screen varies of a 5-hp. electric motor for screens of 6-mesh and finer to 7½ h. p. for the coarser screens. The motors, of course, are d. c. or a. c. and of any ordinary voltage desired. Pulley-drive may be substituted for the motor drive.

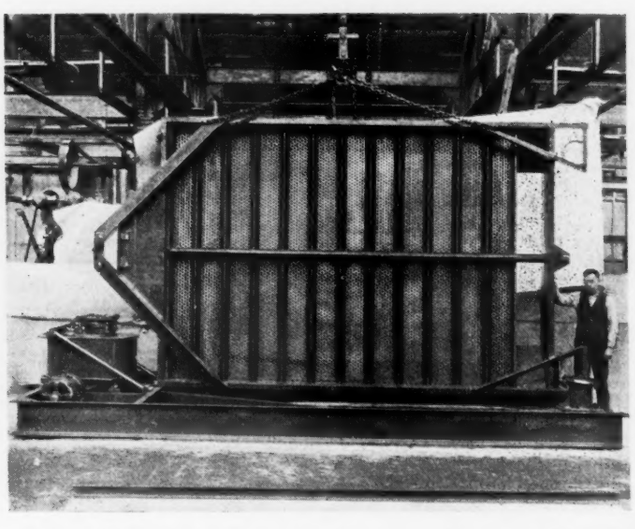
One advantage of the new screen is the small headroom required. The height over all is 4 ft.

The screen includes a patented "ball-and-bevel-partition" mesh-cleaning system, which operates by the wiping contact of the balls with the screen as well as by the vibratory effect set up in the screen by the balls striking rapidly, forcibly and uniformly against the entire undersurface of the screen.

The f. o. b. Cincinnati price of the screen is $2000.



Rotex jumbo-screen, complete and ready to run. A small Rotex No. 3 sifter is shown alongside for comparison



Screen box of the Rotex jumbo-screen disconnected and raised on edge with screen cloth removed

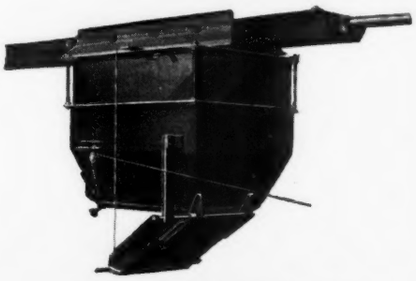
Concrete Aggregate Batcher

THE Blaw-Knox adjustable measuring batcher, which is used for the automatic and accurate proportioning of concrete aggregates, has many new features in the 1925 design which have increased its utility, prolonged its life and increased its labor saving features, according to the manufacturers. These features are detailed in the following paragraphs:

"The 1925 batchers are interchangeable, that is the construction of the sand and stone batcher is identical. This gives the user a greater latitude in the use of his equipment and increases the standardization of his outfit.

"The lower section of batchers is built truly square and, therefore, it can be turned and replaced on the upper cone so that the discharge gate opens in any direction. This enables the user to suit the delivery of the measured batches from the batcher to the varying requirements.

"A semaphore indicator is built into the batcher which works automatically with the loading and discharging of material. A glance tells the operator whether the batcher is full or empty.



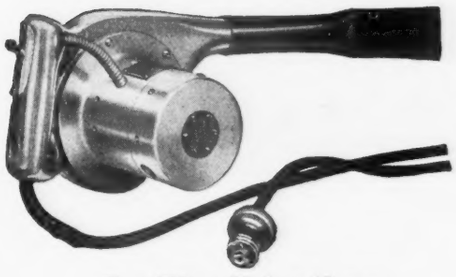
Concrete aggregate batcher

"A non-jam strike-off gate is part of the equipment. This gate operates on roller wheels mounted on a track and enables the material to be struck off and the bin discharge closed with a single motion of the operating lever.

"The batchers are shaped to a slope of 60 deg. or better, which insures clean discharge. Their electrically welded construction gives a smooth interior, obviating the possibility of material sticking within.

"The batcher discharge door is supported on forged steel hinges, giving great additional strength, operating on 1¼-in. cold rolled steel shaft. Two forged steel latches are provided for each door, the whole giving proper support to the door and unfailing latch action on the job. The

One-hand operated blower



New "Marvel" dust blower

discharge openings of doors are larger than in the previous models; hence more rapid discharge than ever.

"The counterweights are equipped with plow steel cables leading to batcher latches, which add greatly to the life of the equipment under the mose severe operating conditions."

Novel Cement Slurry Agitator

F. L. SMIDTH & CO., New York City, are calling the attention of the trade to the slurry agitator installed by them at the plant of the Glens Falls Portland Cement Co., and described for the first time in any American periodical in ROCK PRODUCTS of December 27, 1924. A more complete description follows:

"The concrete basin is 125 ft. long, 25 ft. wide and 21 ft. deep and has a capacity of slurry sufficient for approximately 7,350 bbl. of portland cement. The basin is located under the rotary kilns, thus saving considerable floor space in the plant.

"The slurry is delivered to the basin at one end and pumped out at the center to the kiln feeders. The overflow from the feeders is returned to the basin by gravity at the end opposite the intake.

"The agitation is accomplished by means of revolving stirring arms suspended in a structural steel frame from a platform which travels automatically back and forth the length of the basin, requiring about 15 minutes for the round trip. In addition to the mechanical agitation, air is also injected into the mix through nozzles on the stirring arms. A very uniform and intimate agitation of the slurry is obtained.

"All the operation and control machinery is mounted on the traveling platform. Two motors are required, a 10-hp. motor being used for the agitators and a 5-hp. motor for the travel. Only two pairs of bevel gears are used for the agitators. The electric power cable and the air hose are wound and unwound automatically on drums located on the sides of the platform.

"The first cost of an installation of this design, for the capacity obtained is cheaper than the usual method of individual basins or tanks. The saving in power in the installation illustrated amounts to from 50 to 60 hp. There are many less working parts and the upkeep and repair costs are greatly reduced."

New Portable Dust Blower

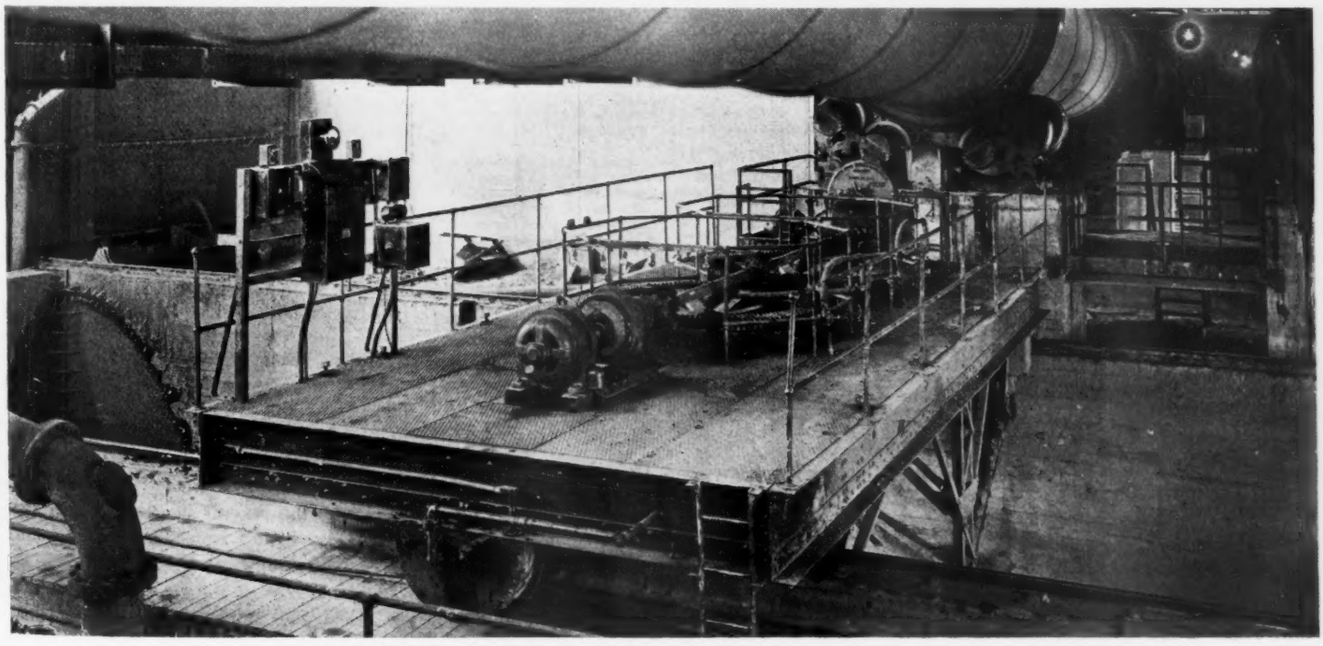
THE "Marvel" dust blower for cleaning motors, generators, switch boards and other machinery is a one-hand operated machine, weighing 6½ lb. and is controlled by a switch in the handle manipulated by the thumb. The casing is aluminum.

Not the least desirable feature of this device is that it is furnished with 110, 220 or 250-volt universal motors, as desired. These motors develop ½-hp. and have a speed of 8000 r.p.m. giving a pressure of 8 to 9 ounces.

The machine is furnished with a 20-ft. high grade electric cable and an armored plug, designed to withstand shocks from dropping on hard floors. It is manufactured by the Electric Blower Co., of Boston, Mass.

Construction Company Doing Extensive Concrete Work for New Cement Plants

THE Spencer Construction Co., Baltimore, Md., has secured contracts and is progressing with the building operations covering all the reinforced concrete construction for the two new cement plants for the Wabash Portland Cement Co., at Osborn, Ohio, and the Diamond Alkali Co., at Painesville, Ohio. The Ohio Marble Co., Piqua, Ohio, has awarded the company a contract for miscellaneous concrete work, including circular reinforced concrete storage bins. The company is also in the midst of construction of a new stock house for the Lehigh Portland Cement Co., at the Birmingham, Ala., plant and are completing reinforced concrete work for the new plant of the Clinchfield Portland Cement Corporation at Coreen, Ga.



Traveling cement slurry agitator at the plant of the Glens Falls Portland Cement Co.

Traffic and Transportation

By EDWIN BROOKER, Consulting Transportation and Traffic Expert
Munsey Building, Washington, D. C.

Proposed Changes in Rates

THE following are the latest proposed changes in freight rates up to the week beginning March 3:

Illinois Freight Association Docket

2391-A. Cement. Carloads:

To—	From Dixon, Ill. Pres.	Dixon, Ill. Prop.	La Salle, Ill. Pres.	La Salle, Ill. Prop.
*Dayton, Ohio	16	16	15½	15½
†South Dayton, Ohio	16½	16	16	15½
†Meraine, Ohio	16½	16	16	15½
Franklin, Ohio—				
Cin. Nor.	15	16½	14	16
C. C. C. & St. L.	16½	16½	14	16

To—	From St. Louis, Mo. Pres.	St. Louis, Mo. Prop.	Hannibal, Mo. Pres.	Hannibal, Mo. Prop.
*Dayton, Ohio	16	16	17	17
†South Dayton, Ohio	16	16	17½	17
†Meraine, Ohio	16	16	17½	17
Franklin, Ohio—				
Cin. Nor.	16	16	17	17
C. C. C. & St. L.	16	16	17	17

*Rates will not apply on traffic destined to South Dayton, Ohio, and Meraine, Ohio.

†Rates will not apply on traffic received from connecting lines at Dayton, Ohio, for delivery at South Dayton, Ohio, and Meraine, Ohio.

2547-A. Sand. Carloads, minimum weight marked capacity of car. From Lincoln, Ill., to Tolono, Ill.: Present, 80 cents; proposed, 88 cents (per net ton). From Pekin, Ill., to Tolono, Ill.: Present, 95 cents; proposed, $1.03 (per net ton).

3026. Sand, molding. Carloads, minimum weight 90% marked capacity of car, except when car is loaded to full cubical or visible capacity actual weight will apply, but not less than 40,000 lb., from Tamalco and Arenzville, Ill., to Detroit, Port Huron, Grand Rapids, Mich., Wabash, Marion, Vincennes, Ind., etc. Present, classification basis. Proposed, Detroit, Mich., $2.52 per net ton; Port Huron, Mich., $2.65; Grand Rapids, Mich., $2.65; Wabash, Ind., $2.14; Marion, Ind., $1.89; Vincennes, Ind., $1.51.

3058. Sand and gravel. Carloads, minimum weight 90% of marked capacity of car, except when actual weight of shipment, loaded to full visible capacity of car is less than 90% of marked capacity, the actual weight will be the minimum, but not less than 40,000 lb., from LaGrange, Mo., to destinations in I. R. C. territory i. e. (per net ton):

To—	Pres.	Prop.
Quincy, Ill.	$1.13	$0.60
Marblehead, Ill.	.....	.60
Golden, Ill.	.90	.90
Macomb, Ill.	1.25	.98
Bushnell, Ill.	1.26	1.11
Galesburg, Ill.	.....	1.11
Adair, Ill.	1.26	1.11
Rushville, Ill.	1.51	1.13

Western Trunk Line Docket

3545-B. Sand and gravel. Carloads, from Morris, Kan., to points within a radius of 150 miles of Kansas City. Present, combination on Kansas City, using rate of 3 cents Morris to Kansas City and local rates beyond, subject to use of Jones' combination tariff. Proposed, to apply the same rates as now in effect from Turner, Kan., to points within a radius of 150 miles of Kansas City. Minimum weight 90% of marked capacity of car, except that when weight of shipment loaded to full visible capacity of car is less than 90% of marked capacity of car, the actual weight will apply. In no case shall the minimum weight be less than 40,000 lb.

Southern Freight Association Docket

18950. Cement. It is proposed to establish rates on cement, carloads, from Birmingham, Boyles and North Birmingham, Ala., to N. & W. Ry. stations, viz.: Durham and Winston-Salem Division, the same as at present in effect from Leeds, Ragland, Ala., Chattanooga and Richard City, Tenn., in lieu of present combination rates.

18978. Cement. Carloads, from Nashville, Tenn., to Plaquemine, La. Present rate, 37½ cents; proposed, 32 cents per 100 lb., made on basis of New Orleans, La., combination.

19000. Sand and gravel. Carloads, from Montgomery, Ala., and pits in the vicinity of Montgomery on W. Ry. of Ala., viz.: Arrowhead, Cantelous Spur, Chehaw, Cooks, Milstead, Mt. Weigh and Rice, Ala., to Chester, Laurens and Newberry, S. C. Lowest combination now applies. Proposed: To Chester, $2.03; Laurens, $1.94; Newberry, $2.07 per net ton. From Montgomery, the rates are based on the proposed Georgia-Alabama scale, while rates from the other points named are the same as suggested from Montgomery.

19011. Cement. It is proposed to establish rates on cement, carloads, from Kingsport, Tenn., to L. & N. R. R. stations in line with rates now applicable from Richard City, Tenn., and Chattanooga, Tenn., while some of the proposed rates are based on the Fourth Section Committee of Southern Carriers' cement scale. Statement of the proposed rates will be furnished interested parties upon request.

Central Freight Association Docket

10177. Crushed stone and crushed stone screenings. Marblehead and Martin, Ohio, to North Jackson, Ohio. Present, $1.40 per net ton; proposed, $1.10 per net ton.

18182. Crushed stone and screenings. Hillsville, Wallford and Shaw Junction, Penn., to points in Pennsylvania (per net ton):

To—	Present rate	Proposed rate
East Sandy, Penn.	$1.75	$1.25
Foxburg, Penn.	1.75	1.40
Parkers Landing, Penn.	1.75	1.40
Silgo, Penn.	1.75	1.60
Rimmersburg, Penn.	1.75	1.60
Lawsonham, Penn.	1.75	1.40

10183. Sand and gravel. (b) Sand, gravel and crushed stone, from (a) Lake Ciecott, Ind.; (b) Kenneth and Lake Ciecott, Ind., to (a) Warren, Ind.; (b) Pitwood, Woodland, Hoopeston and Rossville, Ill. Present, (a) $1.15 per net ton; proposed, (a) 95 cents per net ton; (b) $1.05 per net ton to all stations except Rossville, $1.10 per net ton.

10188. Crushed stone, sand and gravel. Lake Ciecott and Kenneth, Ind., to Tippecanoe, Ind. Present, $1.15 per net ton; proposed, 95 cents per net ton.

10189. Sand., viz., blast, engine, foundry, glass, loam, marl, molding and silica. Hamilton, Ohio, to Decatur, Ohio. Present, 16½ cents; proposed, $1.89 per net ton.

10194. Crushed stone. Woodville and Gibsonburg, Ohio, to Orrville, Ohio. Present, 90 cents per net ton; proposed, 80 cents per net ton.

10196. Sand and gravel. Germantown, Ohio, to Cheviot, Bridgeton, Miami, Valley View, Fernald, Shandon, Okeana and New Kirk, Ohio. Present, sixth class, 14 cents to all points except New Kirk, 13½ cents; proposed, $1.13 per net ton.

10197. Crushed stone. Lewisburg, Ohio, to Cheviot, Bridgetown, Miami, Valley View, Fernald, Shandon, Okeana and New Kirk, Ohio. Present, sixth class, 14 cents to all points except New Kirk, 13½ cents; proposed, $1.36 per net ton.

10216. Gravel and sand, other than blast, engine, foundry, glass, molding or silica. Attica, Ind., to stations on Wabash Ry., Chicago to Streator, Ill., inclusvie (in cents per net ton):

To	Present rates	Proposed rates
Chicago, Ill., to Brisbane, Ill.	330	101
Manhattan, Ill., to Essex, Ill.	126	101
Reddick, Ill., to Wing, Ill.	113	101
Pontiac, Ill.	113	95
Streator, Ill.	113	101

Texas Cement Rates Attacked

FREIGHT rates on cement, said to be discriminatory to Dallas in favor of Oklahoma points, were attacked by the Texas Portland Cement Co. in an Interstate Commerce Commission hearing before Examiner Gault at Dallas recently.—*Dallas (Texas) News.*

Cement Rate Increase Forbidden

A FINDING of non-justification has been made in I. and S. No. 2251, cement from Oklahoma to Texas, and parts of fourth section application No. 627, mimeographed, as to increases proposed in rates on cement from Ada, and Hartshorne, Okla., to points in Texas. The Commission said no evidence was submitted in support of the fourth section application and fourth section relief was denied in fourth section order No. 9075 as of May 25, 1925—*Traffic World.*

Protest Rates on Sand

THE sand rates from Michigan City to points in the Chicago switching district are attacked as too high in Docket 16429, J. N. Bos et al. against the Santa Fe et al., heard at Chicago recently.

H. A. Hollopeter, assistant traffic manager of the Indiana State Chamber of Commerce, testified on behalf of the complainant that, on movements of sand from Michigan City to Chicago, a rate of 88 cents was charged on all shipments since November 5, 1922, while shipments from sand-pits at adjacent points, such as Dune Park, Gary, and Miller, paid only 84 cents. He entered exhibits of rate comparisons and distance tables tending to show that the Michigan City rate should not be higher than the rate to those adjacent points.

J. N. Bos testified that he owned pits at Michigan City and that he met a great deal of competition from the pits at Gary, Dune Park, and Miller, and business into the Chicago market. Because of the freight rate, he said, he was unable to derive the profit from his Michigan City pits that he might were the rate lower.

O. A. Ohlemacher, for himself, and O. W. Lang, for the National Sand and Gravel Company, testified that they owned pits at Michigan City and were in much the same situation as Mr. Bos.

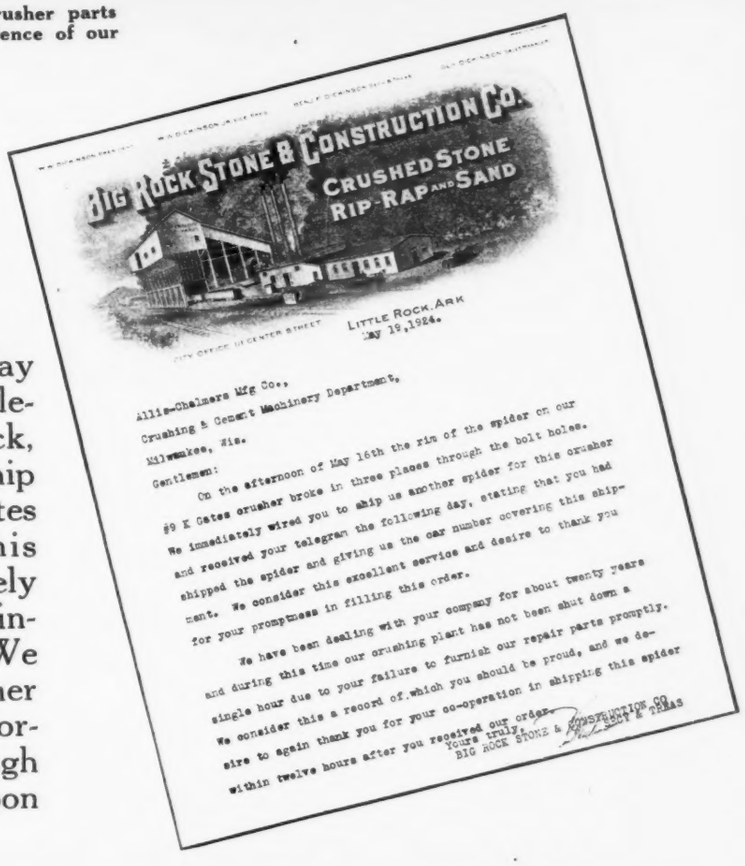
E. W. Brunk, for the Michigan Central, testified for the defendant that rates were generally, taking into account class rates, higher from Michigan City than from Dune Park, Gary, and Miller to Chicago. He said the Commission had passed on that part of the adjustment through Indiana and he thought the charges were fair when compared with the general structure, rather than with the sand rates from the adjacent points. He entered exhibits of statistics showing the volume and cost of the sand movement over the Michigan Central and connecting lines, tending to show that the road found the movement expensive.—*Traffic World.*

A portion of our stock of crusher parts carried on hand for the convenience of our customers.

Service

Here's What It Means

On Saturday morning, May 17, 1924, we received telegram sent from Little Rock, Arkansas, on May 16th to ship one spider for No. 9-K Gates crusher, and although this spider weighs approximately 20,500 lbs. it was in stock finished ready for shipment. We were able to wire our customer that shipment was going forward same day even though our plant closes down at noon on Saturday.



BIG ROCK STONE & CONSTRUCTION CO.
CRUSHED STONE
RIP-RAP AND SAND

LITTLE ROCK, ARK.
May 19,1924.

Allis-Chalmers Mfg Co.,
Crushing & Cement Machinery Department,
Milwaukee, Wis.

Gentlemen:

On the afternoon of May 16th the rim of the spider on our #9 K Gates crusher broke in three places through the bolt holes. We immediately wired you to ship us another spider for this crusher and received your telegram the following day, stating that you had shipped the spider and giving us the car number covering this shipment. We consider this excellent service and desire to thank you for your promptness in filling this order.

We have been dealing with your company for about twenty years and during this time our crushing plant has not been shut down a single hour due to your failure to furnish our repair parts promptly. We consider this a record of which you should be proud, and we desire to again thank you for your co-operation in shipping this spider within twelve hours after you received our order.

Yours truly,
BIG ROCK STONE & CONSTRUCTION CO.

ALLIS-CHALMERS MANUFACTURING CO.
MILWAUKEE, WIS. U.S.A.

News of All the Industry

Incorporations

Westville Sand Co., Camden, N. J., capital $100,000.

Wellston Concrete Products Co., Wellston station, St. Louis, Mo., by D. R. Stover and C. A. Houts.

Mercedes Concrete Pipe Co., Mercedes, Texas, capital $15,000, by Harry L. Seay and W. F. Shaw.

Morley Block and Stone Co., Detroit, Mich., capital $10,000, with headquarters at 402 Detroit Life bldg.

James A. C. Taft and Co., Portland, Ore., sand and gravel, has increased its capital stock to $50,000.

Indiana Stone and Supply Co., Michigan City, Ind., $15,000, by Schuyler and John Harold Powell and Ada L. Cline.

Pacific Aluminous Cement Co., San Francisco, Calif., capital $50,000, by Alfred Whittel, Pierce Zucco and Esmond Schapiro.

Jackson Ridge has engaged in business at 1325 Palmetto street, Los Angeles, Calif., as the Ridge Stucco Products Co.

Reinhart Concrete Block Co., Fort Thomas, Ky., capital $10,000, by A. V. Reinhart, H. Warren Hardesty, Brent Spence and others.

Florida Concrete Building Tile Co., Miami, Fla., capital $55,000, by Lewis P. Fish, president and treasurer and L. M. Johnson, secretary.

Tuscarawas Sand and Gravel Co., Akron, Ohio, by Charles L. Wilcox, Fred T. Childs, Adrian V. Cook, A. Doyle, Jr., and Sarah A. Affleck.

Economy Concrete Products Co., Milwaukee, Wis., $25,000 (250 shares par $100) by Lester E. Schwalee, William P. Siegart and Magdalena Schaltka.

George Mees and Jack Mason have engaged in business at East Villa and Eaton Canyon, Pasadena, Calif., as the Pasadena Rock and Gravel Co.

Plainfield Concrete Block Co., Plainfield, N. J., capital $5,000, by Luigi Dilonardo, Gene and Rosie Bussecco. (Attorney, Samuel Michelman, New York.)

Fitchburg Sand and Gravel Co., Fitchburg, Mass., capital $10,000, by Charles E. Smith, president; Alice E. Prince, treasurer and Clarence E. Tupper.

Ohio Valley Sand Co., New Martinsville, Ohio, capital $100,000, by J. U. and Rua B. Dayton, J. W. and Edna L. Harmon, David Fisher and others, all of New Martinsville.

S. N. Pierson and K. C. Manny of Los Angeles, and O. G. Chamberlain of Alhambra are engaging in business at El Monte, Calif., as the P. and C. Rock and Gravel Co.

Northwest Lime Co., Seattle, Wash., $250,000, by C. H. Graves, D. L. Evans, Lawrence Keefe and C. E. Clendenney. (Attorney, C. H. Graves, 400 Central bldg., Seattle.)

Worth-Haslip-Graham Gravel Co., Inc., Ft. Wayne, Ind., capital $15,000, directors, Lloyd W. Worth, Charles H. Haslip, Oliver G. Graham, Asa W. Dirk and Lester B. Harper.

Missouri Gravel Co., La Grange, Mo., 1000 shares, no par, $12,500, by James E. Cannon and Charles E. A. Bele. Attorney, Joseph C. Cannon, 1110 Federal Reserve Bank bldg., St. Louis.

Artista Sales Co. of New England, New York, capital $60,000, cement products. Incorporators, O. Scherbener, C. K. Sanborn, Jr., D. M. Miller. (Attorney, F. E. Hamilton, 61 Broadway.)

Woodhaven Sand Co., Inc., Jamaica, Long Island, N. Y., capital $25,000. Directors are A. P. Meniz, 9105 30th street, Woodhaven, Long Island, and A. M. Starcke, 691 Quincy street, Brooklyn.

Lillington Sand and Gravel Corporation, Lillington, N. C., 3000 shares of no par value and 300 shares subscribed by Phil H. McGuire and M. A. Campbell of Norfolk, Va., and Chas. Whedbee, Hertford, N. C.

Dallenbach Sand Co., Milltown, N. J., $100,000 by Frederick C. Schneider, Charles P. Stelle, New Brunswick; Jacob Dallenbach, Sr., and Alice Dallenbach, Milltown. Attorney, Fred W. Devoe, New Brunswick, N. J.

Blackwater Stone Co., Kansas City, Mo., $200,000 and 4000 shares of no par value, to operate stone quarries, brickyards and lime kilns. Incorporated by R. Newton McDowell, H. H. Hopkins and William R. Compton, Jr.

Portland Crushed Rock Co., Portland, Me., to quarry, crush and deal in rock, stone and gravel. Three shares of no par value by Charles M. Drummond, president; R. B. Buzzell, treasurer; Wadleigh B. Drummond, clerk.

Goris and Arnstein, Inc., 4850 South Morgan street, Chicago, capital $50,000, to produce and deal in sand, silica and mineral products. Incorporated by Rudolf and Mabel Goris, Emmanuel and Mildred Arnstein. (Correspondent, Ringer, Wilhartz and Hirsch, 76 West Monroe street.)

Sand and Gravel

Pioneer Sand and Gravel Co., Seattle, Wash., will let a contract for erection of a warehouse to cost about $2,500.

A new sand and gravel company will spend $10,000 on a plant at Myrtle Point, Ore., according to a local paper.

Hart township, Mich., recently purchased from W. E. Lewis the gravel pit near the town which it formerly operated on a rental basis.

Monterey Sand and Gravel Co., Salinas, Calif., has filed a dissolution petition in the California superior court. Directors of the company are J. J. Harris, Harriette E. Harris, H. D. Severance, C. H. Siddell and J. P. Pryor.

A. J. Rice is considering the purchase of property in Jefferson county, Mo., in view of the opening of a gravel bed there. Mr. Rice operates with J. H. Haley and John Ringling in supplying railroads and highways with gravel.

Gardenshire and Wier have established a sand and gravel plant at Glendale, Calif., to produce and deal in sand and crushed rock and are reported by a local paper to be running full capacity. The business is owned and operated by A. B. Gardenshire, Jr., and Lee C. Wier.

Gravel beds that are reported to underly most of Dewey county, Okla., are being developed more extensively with increasing building operations in that county. Two companies, one at Fay, on the Oriet Ry., and the other at Camargo, on the M. K. & T. Ry., are now shipping gravel.

Quarries

Topeka Crushed Rock Co. is quarrying and crushing rock near Burlingame, Kan., and furnishing crushed rock for street paving in that city.

Frank S. Paulin & Co., Connelton, Ind., have received a contract to furnish 10,000 tons of stone for dam construction in the Ohio river near Henderson, Ind.

Buena Granite Co., Inc., 505 Ouray bldg., Washington, D. C., will develop a new quarry and install crushing plant. Daily output 1000 tons of crushed stone.

Judge F. B. Ferguson has installed a rock crusher in Searcy county, Ark., and plans to furnish crushed rock for 200 miles of hard surface roads in the Ozark section during the next year.

Standard Lime and Stone Co., Baltimore, Md., has been awarded the contract to furnish 20,000 tons of rock to be used in building a jetty to protect the entrance to the Chesapeake and Delaware canal.

Bauer-Johnson Co. has leased the Quincy, Ill., city-owned quarry for three years at a rental rate of $10,000 per annum. The company has begun stripping operations and is preparing equipment for quarrying operations.

Badger Stone Co., Fountain City, Wis., has been awarded a contract to furnish 10,000 yards of rock, presumably rip rap, for river improvement work. The company has started preliminary work in its quarry.

Two crushed stone companies in the Columbia S. C., district, are reported by Geo. A. Lott, manager of Palmetto quarries, to produce about 500,000 tons yearly and to have an annual payroll amounting to $250,000. The product is distributed throughout southern and eastern North Carolina, southeast Georgia and northern Florida.

James Cahill, who will have charge of the rock quarry to be opened near Excelsior Springs, Mo., is there making the necessary preparations. A railroad siding is to be built and the company has $7,500 worth of equipment on the way. The company expects to produce 200 tons of crushed rock for highway construction and the contracts are already made.

Cement Products

Voyle & Co., Gainesville, Fla., is building a plant to manufacture Duntile.

Louis R. Robinson, St. Louis, Mo., is reported to have purchased a five-acre site on which to erect a concrete building block factory.

Nebraska Artificial Stone Co., is reported to have built a plant at Ralston, Neb., for the manufacture of concrete building blocks. Swan Larson is the proprietor.

Pennsylvania Concrete Roofing Tile Co., Lemoyne, Penn., has built a new plant which is thrice the size of its former plant and is devoted to the manufacture of "Bo-Block," using purified cinder aggregate.

Ideal Cement Stone Co., Ralston, Neb., which operates two plants in that city, has recently begun the manufacture of cinder concrete blocks, under a license from the patent owners, Crozier-Straub, Inc., New York City, along with its regular production of "Star" concrete blocks. The south side plant of the company has a capacity of 3500 blocks per day and also makes trim stone and garden furniture of concrete.

Cement

Dexter Portland Cement Co., announces the removal of its Philadelphia office to 1113 Packard bldg., southeast corner of 15th and Chestnut streets.

South Dakota's cement plant was awarded the $375,000 appropriation by the state legislature by large majorities in both houses after long debate and investigation.

Glens Falls Portland Cement Co., Glens Falls, N. Y., is installing a battery of concrete storage silos, engineering by F. L. Smidth & Co., New York, and construction by McDonald Construction Co., of Chicago.

Gulf States Portland Cement Co., Demopolis, Ala., is planning the installation of an additional 125 ft. kiln with considerable auxiliary machinery. This kiln will increase the output of the plant by 1200 bbl. daily.

British Columbia Cement Co.'s motorship Caria will arrive at Victoria, B. C., soon with a cargo from Newcastle, England. The vessel is equipped with Diesel engines, has a capacity of 400 tons and averages 10 knots per hour.

The cement plants of the Aetna and New Egyptian Portland Cement companies at Fenton, Mich., have opened up at full capacity for the year's run. They report a large number of orders on hand and prospects for a successful season.

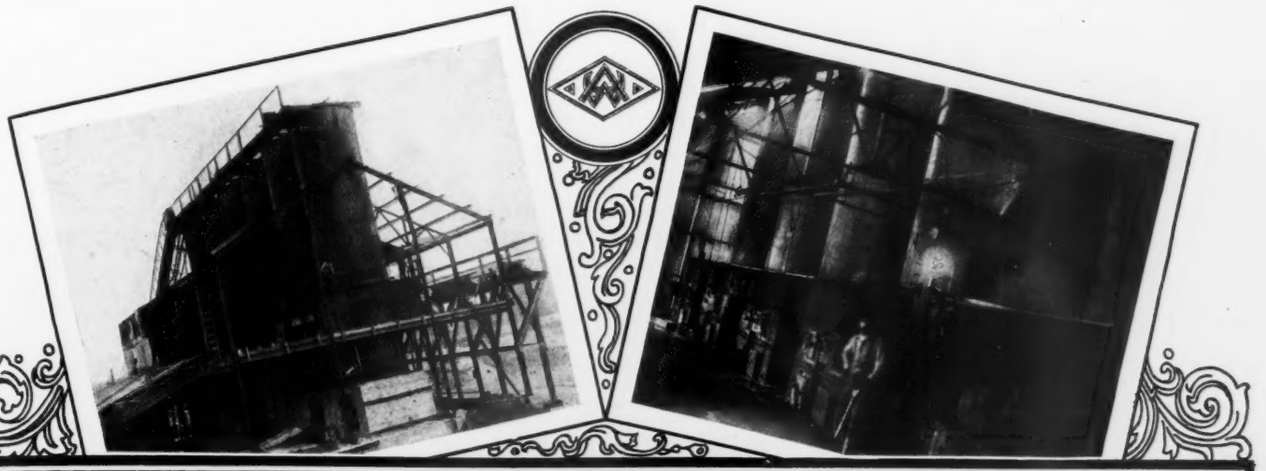
Golden State Portland Cement Co., Los Angeles, Calif., will erect an addition to the cement warehouse at its plant at Oro Grande, Calif., to replace a structure destroyed in a recent fire. The building will be of steel and measure 45 by 160 ft. in area and be 15 ft. high.

Olympic Portland Cement Co., Ltd., will begin full capacity operation at its plant at Bellingham, Wash., on April 1, according to an announcement by A. F. Krabbe, manager, in a local paper. The plant is now running on a half capacity basis and employs about 130 men.

San Antonio Portland Cement Co.'s offices and storeroom at its plant at Cementville, Texas, were damaged by fire recently with a loss of $10,000 covered by insurance, according to a statement by H. O. Rinehold, plant manager, in a local paper.

The Bessemer Limestone & Cement Co., Youngstown, O., is soon to let the contract for construction of concrete cement storage tanks.

Giant Portland Cement Co., Egypt, Penn., has a plant improvement program under way. The work includes the installation of machinery in the clinker mill and other departments.



THE kiln problem at your plant is one that we can solve, as we have solved the problems at other plants. Note the six Arnold Kilns in the plant above that solved one man's problem. So well satisfied with their operation, this plant has grown to eleven kilns, and all within two years' period. Arnold Kilns were pioneers in the field, and they have kept up to the minute all the time. We can show you how to burn your rock in less time, with less labor, less fuel, at a lower cost, and at the same time get a better product. Consult us about your plant needs.

Engineers & Contractors

Weber Hydrators
Arnold Kilns

ARNOLD & WEIGEL
WOODVILLE, OHIO, U.S.A.

Lime

Michel Lime Co., Dallas, Texas, property and plant sold in a bankruptcy sale at Dallas, March 19.

A new crusher is being installed at the Wissota limestone plant south of Spring Valley, Wis. The old crusher has been discarded.

Long Beach Lime and Putty Co., Long Beach, Calif., is having plans prepared for a reinforced concrete sand bunker and a mixer plant.

Upstick Limestone Association, Upstick, Ill., held a meeting recently and voted to deliver crushed rock at $2 per ton. The company was not organized for profit and as the cost of mining the rock has been reduced by experience, the price of the product has been reduced.

Personals

Tompson Finefrock of the United States Gypsum Co., has been sent to Columbus, O., to look after work for the company.

W. H. Slingluff will be in charge of the new sales office of the American Cable Co., at 160 North La Salle street, Chicago, and handle sales of the company's wire rope products in the midwestern states.

William T. Clark has recently joined the engineering staff of the Trico Fuse Mfg. Co., of Milwaukee, Wis. He has had engineering experience both in this country and in Europe and will devote most of his time and ability to service problems.

Paul C. Burton, mechnical designer and inventor of several devices patented for the National Tool Co., Richmond, Ind., and the Mechanical Engineering Co., of Chicago, has recently joined the engineering force of Foote Bros. Gear and Machine Co., of Chicago.

Charles L. Hogan, vice-president of the Knickerbocker Portland Cement Co., recently gave a talk before the Rotary Club of Hudson, N. Y., according to the "Star" of that city, in which he described briefly the origin and development of the various methods for manufacturing portland cement.

Rock Asphalt

Kentucky Rock Asphalt Co., Louisville, Ky., recently elected the following officers: Wiley B. Bryan, president; Wm. H. Tarvin, first vice-president and sales manager; Lewis Appersin, second vice-president; W. J. Cunningham, third vice-president; A. A. Hermes, secretary and treasurer; Miss Brensinger, assistant treasurer.

Silica Sand

Henry E. Smaltz has purchased the quarry and plant of the Lebanon Sand Co., at Lebanon, Penn. It is understood that the corporate name is included in the sale.

Phosphate

J. W. Killinger, mining engineer of San Francisco, Calif., recently spent several days in Paris, Idaho, visiting the mines and plants of the Idaho Phosphate and Bear Lake Phosphate companies on behalf of California clients.

Manufacturers

The Brown Instrument Co., Philadelphia, Penn., in a booklet published recently pictorially presents the value of recorders in plant operation.

Vulcan Iron Works, Wilkes-Barre, Penn., announces the publication of its new bulletin BM-2 on the Fairchild double discharge ball mills.

The Hill Clutch Machine & Foundry Co., Cleveland, Ohio, announces that it has appointed T. L. Rose & Son, Pittsburgh, Penn., as its representatives in that territory.

Miller-Hurst Corporation announces that W. S. Race, formerly with the United States Rubber Co., has joined its organization of foundry and industrial engineers.

Manitowoc Shipbuilding Corporation, Manitowoc, Wis., has been awarded a contract by the Rockport Steamship Co., Cleveland, Ohio, for a large lake boat to be used in the stone and coal trades.

Foote Bros. Gear and Machine Co., Chicago, has made arrangements with Gibbons and Gordon, 532-34 Canal street, New Orleans, La., for the distribution of its products for the territory surrounding New Orleans.

Kolesch & Co., 138 Fulton street, New York, has just issued its 12th edition of its general catalog. It is a volume of 300 pages of data and illustrations of surveying instruments and accessories and drawing materials.

Northwest Engineering Co., Chicago announces that the Wilson Machinery Co., 1526 Sixteenth street, Denver will handle the sale of its equipment and J. R. Keppek will have charge of the Toledo territory at 209 William street, Toledo, Ohio.

H. K. Ferguson Co., Cleveland, Ohio, held its annual meeting of stockholders recently. The usual 8% dividend on outstanding stock was declared and uncompleted business and construction under way on Feb. 1, 1925 was reported five times as great as that at the same time in 1924.

Rupert M. Gay Co., Inc., 114 Liberty street, New York, has shipped a second "Gayco" separator to the Department of Mines, Ottawa, Canada, for use in the new laboratory now being constructed. The first "Gayco" bought by the Department was a 30-in. machine and the new one is a standard 8 ft. separator, intended for use in working out problems on a commercial scale.

L. A. Snow Co., Seattle, Wash., equipment distributors, announces these recent machinery sales in a local paper: one No. 1 Koehring combination crane and shovel to the Superior Portland Cement Co., for use in its plant at Concrete, Wash.; one No. 7 S. Koehring mixer, with electric power attachment, to the Pioneer Sand and Gravel Co., of Seattle, for use in manufacturing a new type of concrete tile.

Crocker-Wheeler Co., Ampere, N. J., has closed its Baltimore, Md., office and opened an office at 101 Mariette bldg., Atlanta, Ga., in charge of George D. Anderson, Jr. S. M. Conant, formerly in charge of the Baltimore office, has been appointed assistant sales manager and is now located at Ampere. The Pittsburgh, Penn., office of the company in charge of J. R. Lewis, will be moved to the Dravo bldg., 300 Pennsylvania avenue, Pittsburgh, on March 28.

EASTON QUARRY CARS

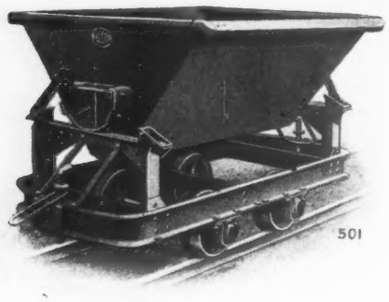


FIG. 501. UPRIGHT POSITION

Bulletin 21 shows other types of quarry cars.

"Quarry Car Practice" published every now and then.

Knowledge

In purchasing quarry cars there are only four kinds of factories to choose from.

A Those who know not and know not they know not.
B Those who know not and know they know not.
C Those who know and know not they know.
D Those who know and know they know.

EASTON CAR & CONSTRUCTION CO.
EASTON, Pa.

New York Philadelphia Pittsburgh
Chicago San Francisco

EASTON CARS
FOR EVERY PIT MINE & QUARRY